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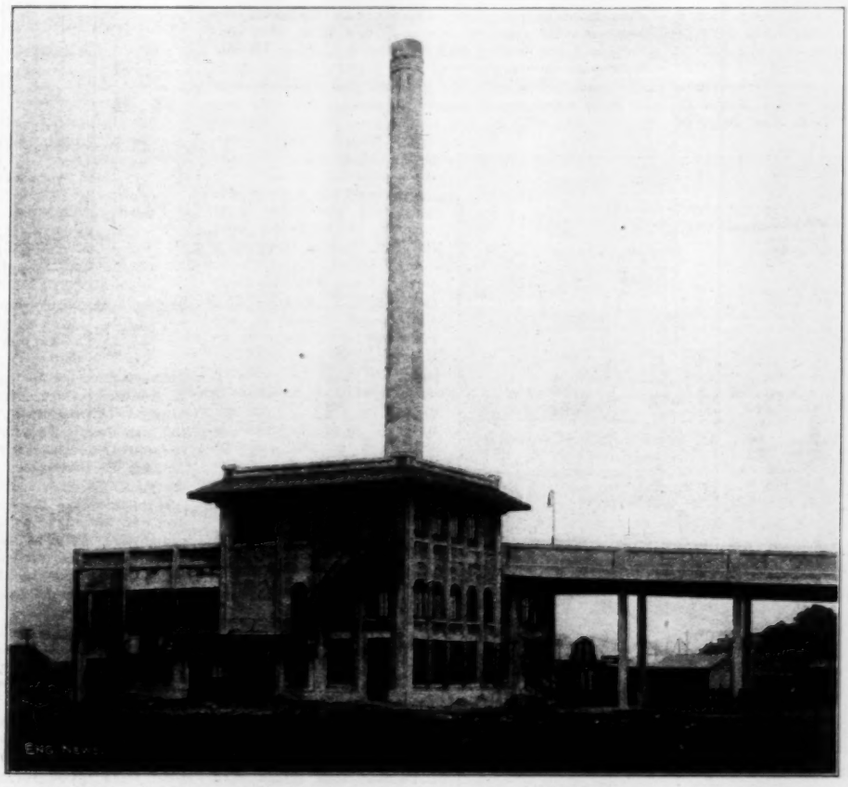
## A NEW REFUSE DESTRUCTOR FOR WEST NEW BRIGHTON, BOROUGH OF RICHMOND, NEW YORK CITY.

The completion of several refuse destructors in accordance with the best modern ideas, within the past year or two, gives reason to believe that the United States will not much longer lag behind Great Britain in this important branch of sanitary engineering, as it has in the past. One of the latest and most interesting of these installations has been recently put in operation at West New Brighton, Borough of Richmond, New York City. We reprint below an official report on the destructor, made by Mr. J. T. Fetherston, Superintendent of Street Cleaning, Borough of Richmond. This report, combined with the general specifications on which bids for furnishing plans were invited (Eng. News, Dec. 6, 1906), will give a good idea of the West New Brighton destructor and the character of the material with which it has to deal.

The destructor was visited by a member of the editorial staff of this journal a few days ago. So far as could be judged by a brief inspection, the installation and its work compares favorably with the best of the British plants, unless it be in that thus far no use is being made of the considerable amount of steam developed by the heat from the destructor. In the matter of heat utilization, those in charge of the plant have done well, we think, to proceed with caution. It is expected that the steam will be utilized soon.



GENERAL VIEW OF REINFORCED CONCRETE REFUSE DESTRUCTOR BUILDING AND APPROACH, WEST NEW BRIGHTON, BOROUGH OF RICHMOND, NEW YORK CITY.

No odors were noticed in or about the plant. There was a slight amount of smoke coming from the stack, and that was of light color. The clinker appeared to be of good quality, but much of it was in large chunks.

Some difficulty has been experienced with leakage through the reinforced-concrete roof. This concrete was originally treated with some one of the waterproofing compounds, we understand, which proved to be a waterproofing that did not hold water. The roof is now being covered with roofing felt, laid in hot coal tar.

A considerable weeding out was required before satisfactory stokers were secured at the destructor. These men are paid what to our British cousins will seem to be the enormous wage of $75 a month, or approximately, as the men work, $3 a day.

A notable feature of the installation is its equipment with a variety of the most modern instruments for measuring the work accomplished by the plant. Reference to these instruments is made in Mr. Fetherston's report below. This plant, we believe, is unique in having so complete an equipment of instruments. The report follows:

Borough Hall, New Brighton, N. Y. City, Sept. 1, 1908.
Mr. Louis L. Tribus,
Commissioner of Public Works.

Dear Sir: On account of the numerous requests for information concerning the new refuse destructor at West New Brighton, and for purposes of record, it seems advisable at this time to summarize the main factors which led to the erection of the new plant; to describe its general construction and to give the results of the official acceptance tests, in so far as these data may be of interest not only to the citizens of this Borough, but also to officials in other cities concerned with the problem of municipal refuse disposal.

HISTORICAL.—In 1904, it became fully evident that a change was necessary from the then existing method of refuse disposal. A plan was devised to met the local conditions by the establishment of one garbage crematory in an isolated location, transportation to be by existing electric or steam railway lines from central receiving stations, located in the populous districts. This project was carefully considered, and a contract advertised.

One bid was received, amounting to $1.25 per ton for refuse transportation. As the city proposed to provide land and erect buildings at the central receiving stations, and the bidder offered to furnish only a portion of the equipment, the price demanded was deemed exorbitant and the contract was disapproved. Later attempts in consultation with officials of the transportation companies to obtain a lower price failed and the project was finally abandoned.

At this time (1904), it was the general practice in the larger American cities to treat garbage by the reduction process, recover valuable by-products and use the ashes, rubbish and street sweepings for filling low-lying land. The picking or trimming of the different classes of refuse to recover valuable articles was more or less general, and in some cities, notably New York, Boston and Buffalo, rubbish remaining after sorting was burned in an incinerator. This method was not suited to Richmond Borough because of the small population (80,000) scattered over an area of 57 sq. mi. In many of the smaller cities of this country, as well as in this borough, garbage was separated from other solid wastes and cremated. Garbage furnaces were built at New Brighton and West New Brighton, and the latter continued in service until superseded by the new destructor.

After a general review of the known methods of refuse disposal, it appeared that by mixing all household refuse (ashes, garbage and rubbish) together and burning it in a so-called destructor, following the method developed in Great Britain, this system might best meet the local situation, provided complete combustion of the organic wastes could be attained. The existing information, both general and local, concerning the character of refuse proved insufficient to determine the probable success of this method, so it was deemed advisable to make thorough analyses, calorific tests and practical experiments. During 1904, 1905 and 1906, local experimental data were accumulated and forty destructor installations were examined in Great Britain. The information thus obtained resulted in the request for bids based upon a contract, specification and general plan for a mixed refuse destructor to serve one district at West New Brighton. Bids for the furnaces, etc.,

were opened in December, 1906, and a type of destructor was selected after detailed analyses of the proposals. A separate contract for the foundations, buildings, runway and chimney of the new plant was afterwards entered upon, and construction work begun in June of 1907. The whole installation was completed and drying fires started in the furnaces during March, 1908. In May, 1908, a test covering the period of two weeks was carried out to determine the adequacy and sufficiency of the furnace contractor's guarantees.

The foregoing facts have also been published at some length in the engineering journals; in a paper presented before the American Society of Civil Engineers in December, 1907, and in another before the Society of Chemical Industry in March, 1908. [See Eng. News, Dec. 6, 1906, for general specifications on which bids were received, including tables of quantities and character of refuse.—Ed.]

LOCATION.—While two destructors were recommended for early construction in the original report, it was decided to erect the first plant at West New Brighton. This district contains a population of about 26,000 people and covers some 4,800 acres. Land was purchased on the north side of Richmond Terrace at the foot of Taylor St., West New Brighton, about midway between the extreme ends of the district and somewhat north of the central portion, on the borders of the Kill von Kull (tidal). From southeast to southwest, the adjoining section is mainly residential, while in other directions the properties are used for industrial purposes. Vigorous protests were made before construction by householders living in the neighborhood of the proposed plant, but as no more suitable site could be obtained, it was decided to proceed with the original plans. That the opposition to the erection of the destructor was mainly sentimental has been demonstrated since the plant was started operating in March of this year, as no complaints of nuisance have been received either by the Department of Health or this office. The nearest living apartment is located about 200 ft. away from the destructor building.

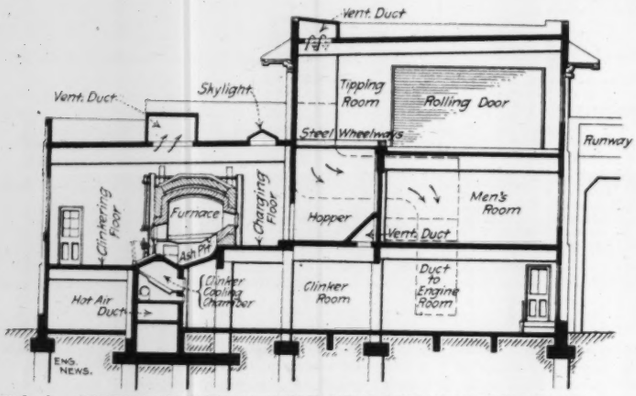



FIG. 2. SECTION THROUGH WEST NEW BRIGHTON REFUSE DESTRUCTOR BUILDING.

STRUCTURAL WORK.—The building, runway and chimney (Fig. 1) are built on a marsh containing from 18 to 20 ft. of soft mud, overlying a firm sand foundation. The price of various building materials at the time the plans were drawn for the structural work indicated that reinforced concrete would best meet the conditions at the site. In order to provide a working platform for a pile driver, a mattress of mixed ashes and rubbish was placed over the marsh and served acceptably for this purpose.

Piles were of built-in-place reinforced concrete type. A stout hollow steel shell with a detachable point was first driven to a firm bearing; a light inner shell was then fitted in position; steel rods with horizontal ties were inserted; the interior shell was filled with concrete and the driving shell withdrawn, leaving the concrete with the vertical steel rods held in position inside the temporary casing. The concrete piles averaged about 26 ft. in length and numbered 107 in all. Two piles were loaded each with 45 tons of pig iron for test purposes and proved satisfactorily their ability to carry the loads required.

The building, runway and connecting flue were constructed in reinforced concrete, but had no particularly novel structural features. The chimney was also built of reinforced concrete, with an interior lining of fire brick for a distance of 20 ft. above the base. A section through the working portion of the building is shown by Fig. 2. An exterior view of the plant is given on p. 485 and indicates to some degree the success attained in the attempt to make it attractive in appearance. The open spaces under the runway will later be enclosed to serve as store houses and work shops. The plans of the building, as completed, followed closely the preliminary drawings accompanying the specifications upon which the contract for the destructor was made:

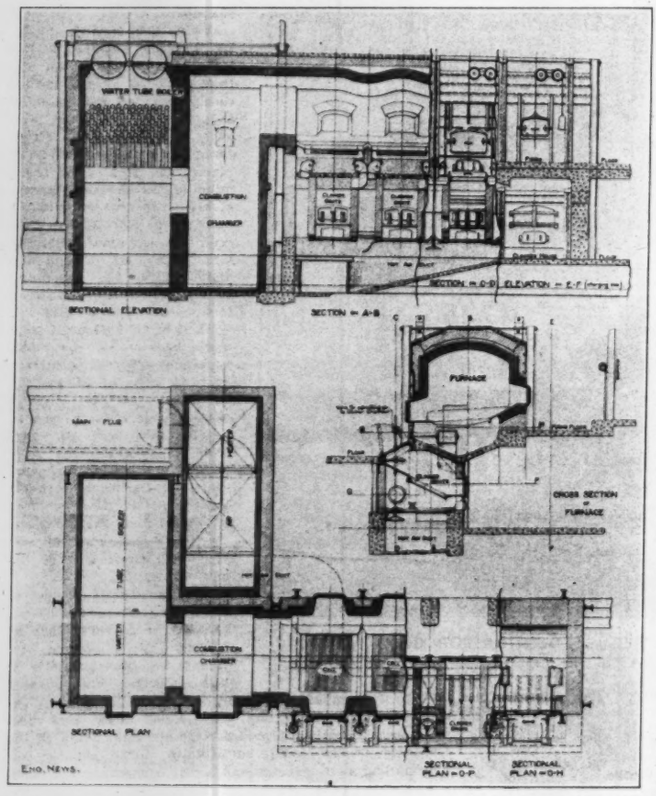



FIG. 3. SECTIONAL DETAILS OF WEST NEW BRIGHTON REFUSE DESTRUCTOR.

FURNACE, BOILER.—The destructor proper consists of one unit of 60 [short] tons capacity per 24 hours, containing four grates with divided ashpits, each grate being served by one clinker cooling chamber. There is one 183-HP. Babcock & Wilcox water-tube boiler, without a coal grate; one air heater or regenerator, a fan for forced draft, and such appurtenances as boiler feed pumps, ventilating ducts, etc. Fig. 3 shows in detail the general construction of the furnace.

Carts and wagons enter the property from the street level and proceed up an inclined roadway to the tipping room, after being weighed on a temporarily installed scale.

Carts tip their loads directly into the storage hoppers shown in Fig. 2. Wagons of the bottom-dump variety, which have recently been tried, back over on steel wheel-ways, composed of deck beams and angles. When in position, the bottom leaves are opened and the load is deposited in the hopper.

Refuse is shoveled by hand from the hopper four grates, in rotation. This method of feeding seemed desirable in a first installation of this character, as there would be better control over the character of the material and refuse of good quality would avoid burning the poorer kind. After the successive charges of refuse on the grate are burned, a residue in the form of clinker or slag accumulates, which must be removed at intervals depending upon the amount of combustible material contained in the refuse. Clinker is withdrawn from the furnace while in a highly heated condition and drops through trap doors in the floor (Fig. 2) to the clinker-cooling chamber (Fig. 2) immediately below the furnace and on the ground level of the plant. Air for combustion is passed through this highly heated material and returned to the furnace to assist in drying the new charges of green refuse. In this way, energy in the form of heat is conserved and the firemen or stokers work much more comfortably than if they had to wheel away the hot clinker in barrows, as is done in practically all British plants. After the clinker has been sufficiently cooled by the air passing into the furnace, it is deposited in wheelbarrows and removed without difficulty. At present, it is used for making land about the building. The provision of the clinker-cooling chambers was made a portion of the original specification for the destructor, and is rather a novel feature of the plant.

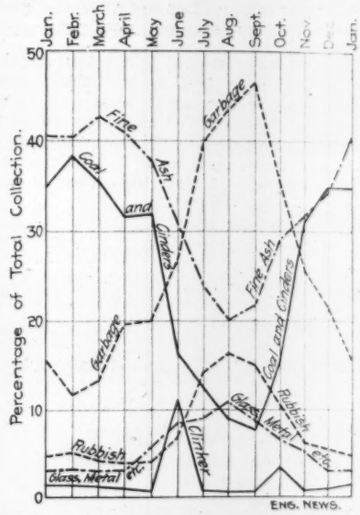



Fig. 5. Monthly Variations, by Weight, of West New Brighton Household Refuse, as Determined in 1904-6.

The gases from the burning refuse in the furnace pass over the successive grates, mix and are oxidized in the combustion chamber before entering the boiler. In other words, the furnace is arranged to secure complete combustion before the gases impinge upon any comparatively cool substance such as boiler tubes. After passing through the boiler, the gases enter an air heater, which consists of a number of pipes through which the gases pass and outside of which air for combustion in the furnace is forced by the centrifugal fan. On leaving the air heater, the gases pass to the main flue and thence to the chimney. As there is more or less fine dust contained in refuse, the destructor is arranged to deposit fine materials at various parts of the combustion chamber, boiler setting and air heater to provide against their escape from the stack. Fig. 4 shows a view of the furnace as constructed. The furnace contractors spared no expense of time or money in making the destructor the best possible in all respects.

THE TESTS.—As required by the specifications, a series of tests covering a period of two weeks was started in the early part of May, after the completion of the furnace and when the brickwork had been sufficiently dried by slow fires. Two mixtures, containing components of refuse representing the classes of materials collected during the two extreme months of the year (September and February), were compounded. These mixtures contained the actual weights of materials shown in Table I., which summarizes the main features of the five official tests conducted at the plant. Midseason refuse was represented by the materials as collected during the month of May. The composition of the two extreme mixtures followed the results obtained from the mechanical analyses of refuse shown in Fig. 6. [Fig. 5 shows the monthly variations of weight of the household

refuse.—Ed.

[illegible]re each test was started the compara-
tively cold [illegible] was heated by means of paper, wood
and a smal[illegible]nt of coal. Refuse was then charged
until the f[illegible] was in a fair working condition. This
usually co[illegible] from one to two hours. After the
official te[illegible] started, refuse was burned for the
periods in[illegible] in the accompanying table and the
test was [illegible]d when the last charge was fired and

FIG. 4. CLINKERING SIDE OF WEST NEW BRIGHTON REFUSE DESTRUCTOR.

(The trap doors for letting the clinker into the chamber below may be seen in this view; as also the pulleys and balanced weights for raising the clinker doors and the rods for operating the damper regulators.)

after pressure, temperatures and furnace conditions were equalized.

Observations were made every fifteen minutes, with regard to the main factors involved. Combustion chamber temperatures were continuously indicated by a Féry radiation pyrometer, connected with an indicating galvanometer. Boiler outlet temperatures were obtained by means of a Bristol electric indicating pyrometer; chimney gas temperatures were obtained by a mercury nitrogen thermometer; heated air temperatures, outside air, etc., by means of mercury thermometers. Instruments recording temperatures were compared before and after the trials. Gas samples were analyzed for $CO_2$ at intervals of 2½ minutes by an automatic combustion recorder made by Simmance & Abady, and check analyses were made by an Orsat apparatus. Steam pressures were read directly from the boiler gage and obtained continuously by a Bristol pressure recorder. Boiler feed water was measured by a meter, which was tested before and after the trials. The summary in the accompanying table gives a number of features which may prove of interest to those concerned in the disposal of mixed refuse by fire. The operating force conducting the trials consisted of one steam engineman and four stokers or firemen. Three of the stokers were employees of the local bureau who had never before worked about any steam raising plant and had never had any experience in high temperature work. They had received about one month's preliminary training in the work about the furnace. Probably, with more experienced men, even better results could be obtained than those indicated in the summary of the trials. Tests were made under the joint supervision of the furnace contractor's engineer, Mr. F. P. Rudder, M. Inst. M. E. [British] and the writer, assisted by competent observers.

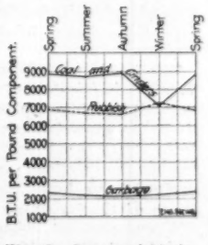



Fig. 6. Seasonal Variations in Calorific Power of Samples of Components of West New Brighton Refuse.

After the furnace had satisfactorily met the conditions and requirements of the contract and specifications, it was accepted, and on May 21, 1908, it was taken over by the city. It has continued to satisfactorily dispose of mixed refuse during the trying summer period when the proportion of garbage is very high, and bids fair to satisfactorily perform its duty in the future.

COSTS.—The capital costs of the plant were as follows:

| | |
|---|---|
| Land (100 ft. × 300 ft.) | $5,000 |
| Foundations, building, chimney, runway, retaining wall, etc. | 39,500 |
| Furnaces, boiler, etc. | 23,995 |
| Total | $68,495 |

There are perhaps more inquiries made concerning the cost of operation of the new plant than any other factor connected with it. In every case, it has been stated that until the plant has been operating continuously throughout a refuse cycle (which covers a period of one year), it will not be possible to give any reliable cost data regarding maintenance charges. A full report on the total cost of collection and disposal for the district served by the West New Brighton destructor will be made when all charges are available. Statements of partial costs only prove misleading.

Though the main object of this installation, a sanitary disposal of the wastes, has been achieved, there are still many factors concerning the more effective treatment of mixed refuse at the new plant yet under consideration, such as the benefit derived from the heat abstracted from the clinker in the cooling chambers, the ordinary amount of power produced under average operating conditions, the best utilization of such power, and the most economical treatment of the other by-products, including clinker, tins, dust, etc. No decision has yet been made regarding these matters, and it is deemed prudent to postpone such a decision until sufficient information has been secured to wisely determine their most economical use.

The preliminary stages in our work have proven very interesting and enlightening; the current stage of operating the plant and experimenting with a view to the best disposition of by-products is a fertile one for the imagination, and it is hoped will prove satisfying in its final results.

Yours respectfully,

J. T. Fetherston,
Assoc. M. Am. Soc. C. E.,
Superintendent Bureau of Street Cleaning.

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The officials and contractors concerned in the building of the West New Brighton refuse destructor are as follows:

President of the Borough of Richmond, George Cromwell.
Consulting Engineer and Commissioner of Public Works, Louis L. Tribus.
Superintendent of Street Cleaning, J. T. Fetherston.
General contractors:
For building, etc., McHarg-Barton Co., New York.
Sub-contractors:
For foundations, The Foundation Co. of New York.
For building and runway, Heineken, Bayne & McCarthy, New York.
For chimney, The Chimney Const. Co., Philadelphia.
Contractors for furnace, boiler, etc., Heenan & Froude, Ltd., Manchester, Eng.
Furnace appurtenances, etc., Power Specialty Co., New York.

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IRON AND COAL PRODUCTION as compared with 1907 shows a large deficiency, though the monthly figures have been picking up continuously since the first part of the year. Anthracite shipments for the nine months Jan.-Sept., 47,021,000 tons, are only 5% below the corresponding 1907 figure, and there is about the same proportionate difference between the figures for September production. Bituminous coal and coke, however, show a production lower by 12% for September, 1908 and 25% lower for Jan.-Sept., 1908 than for the same periods of 1907. Coke production is particularly low; the average weekly production at Connellsville for September was about 19,700 tons, against 427,000 tons during Sept., 1907, a decrease of 54%, and the nine months' figure shows 58% decrease. Pig iron production in September, 1,419,000 gross tons, is about 35% below the corresponding figure of a year ago, and the nine months' figure for 1908 is 46% below. Great Lakes traffic between domestic ports in September, 1908, was 9,459,000 net tons, against 11,138,000 tons in 1907, a decrease of 15%, due mainly to smaller iron-ore shipments. Grain shipments, however, were much larger this year. Internal commerce in other commodities shows in general similar decreases as those for iron and coal, though grain and cotton traffic is much larger this year.

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THE PRODUCTION OF QUICKSILVER in the United States in 1907 is given in a bulletin of the U. S. Geological Survey as 21,567 flasks of 75 lbs. each, valued at $828,931. Compared with the production of 1906, this shows a decrease of 4,671 flasks in quantity or $129,703 in value. An output of quicksilver was reported from but three states in 1907—California, Texas and Utah. California furnishes about 80% of the domestic production.

SUMMARY OF OFFICIAL TESTS, WEST NEW BRIGHTON REFUSE DESTRUCTOR, BOROUGH OF RICHMOND, NEW YORK CITY.

| Date of test, 1908. | Test No. | Description. | Refuse burned—Composition and character. | | Dur-ation of test, hrs. | Total refuse han-died, tons. | Refuse burned, tons. | Am't of refuse burned per sq. ft. of grate per hr., lbs. | Residual—Clink-er, lbs. | Ashes, lbs. | Dust, (ap-prox.) lbs. | Tins, etc. not fired, lbs. | Per-cent-age of or-iginal refuse. | Evaporation per lb. refuse burned. Gross and act-ual, lbs. | Gross Net useful equiva-lent from and at 212° F., lbs. | Net useful steam for power purposes, from and at 212° F., lbs. | $CO_2$ Aver-age % | $CO_2$ Max-imum % | $CO_2$ Min-imum % | Temperature in ° Fahr. Combustion chamber. Aver-age. | Combustion chamber. Max-imum. | Combustion chamber. Min-imum. | Chim-ney gases. | Out-side air. | Air leaving heater | Feed water | Average steam pres-sure in lbs. per sq. in. | No. of fires clink-ered. | Average time per clinker-ing, min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May 6 | 1 | Sept. mixture as per specifications. | Components. | % | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Garbage | 40.6 | 8 | 21,325 | 20,892 | 52. | 10930. | 787. | 426. | 1046. | 13189. | 30.9 | 1.17 | 1.41 | 1.31 | 12.2 | 17.0 | 6.0 | 1846. | 2210. | 1546. | 393. | 48.5 | 396. | 55. | 137.4 | 9. | 9. |
| | | | Fine ash | 21.7 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Coal & cinders | 0.6 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Clinker | 25.6 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Tins, metal, etc. | 8.5 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Rubbish | 14.9 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Total | 100.0 | | | | | 42050. | | | | | | | | | | | | | | | | | | | |
| May 8 | 2 | Refuse as collected. | Wet from rain. Sample dried gave 38% moisture. | | 6¾ | 16,315 | 16,145 | 49.7 | 8860. | 787. | 326. | 340. | 2843. | 30.2 | 1.03 | 1.25 | 1.16 | 12.3 | 16.5 | 8.0 | 1716. | 1922. | 1526. | 380. | 51.5 | 287. | 55. | 133.2 | 8. | 8.4 |
| May 13 | 3 | Feb. mixture as per specifications. | Components | % | 8 | 20,051 | 19,827 | 49.6 | 11466. | 1078. | 401. | 448. | 14293. | 35.6 | 1.10 | 1.33 | 1.24 | 12.5 | 17.0 | 6.0 | 1637. | 1940. | 1382. | 364. | 83.9 | 268. | 56. | 130.5 | 10. | 11.9 |
| | | | Ashes | 79.3 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Garbage | 11.8 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Rubbish | 5.3 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Glass, Metal, etc. | 3.4 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Total | 100.0 | | | | | 40102. | | | | | | | | | | | | | | | | | | | |
| May 15 | 4. | Refuse as collected. | Wet from rain of previous day. | | 5½ | 17,430 | 17,235 | 62.7 | 12905. | 699. | 349. | 349. | 14372. | 41.2 | 0.91 | 1.10 | 1.02 | 12.4 | 17.6 | 8.6 | 1698. | 1904. | 1526. | 397. | 50.6 | 288. | 54. | 136.4 | 7. | 12.3 |
| May 16 | 5 | Refuse as collected. | Relatively dry, representative material. | | 8 | 23,947 | 23,673 | 59.2 | 17844. | 946. | 477. | 349. | 19983. | 43.0 | 1.00 | 1.24 | 1.12 | 12.9 | 16.3 | 7.6 | 1702. | 1949. | 1614. | .... | .... | .... | 54 | 137.4 | 5 | 8.2 |

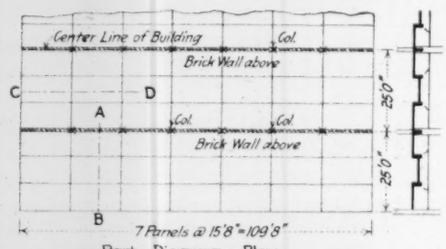
## FAILURE OF A REINFORCED-CONCRETE FLOOR OF UNUSUAL DESIGN.

By H. ALEXIS d'O. SAURBREY.*

During the months of February and March, 1908, an investigation was made of a newly completed manufacturing plant in the city of Cleveland, O., in which several structural defects had been discovered after the buildings had been taken in use. While most of the buildings were found to be in serviceable condition others gave plenty of evidence of being badly overloaded and otherwise insufficient for the purpose intended. This is particularly true of the tank house, a brick building with floors and columns of reinforced concrete. In his capacity of consulting concrete engineer for the investigating committee the writer had occasion to examine the reinforced concrete work in this building, a short description of which may be of interest.

The plan and sections in Fig. 1 show the building as it was found at the time of the examination, with large cracks extending from the bottom of the main girders into the stems of same.

The building is two stories high, with a concrete basement floor resting on the fill,* and an upper story carried on beams and girders of reinforced concrete supported by concrete columns. Attention is called to the peculiar shape of the main girders, the central portion of which is depressed 24 ins., forming a lower passage between the higher tank platforms, on each side. Each platform carries one row of tanks, the tanks being 8 ft. on centers. Each tank with contents weighs about 20,400 lbs. when full. Three brick partition walls divide the upper floor into four isolated compartments 25 ft. wide, to which access is had through a door in the end only, connected on the outside of the building by means of a cantilever runway of structural steel. Only such details are shown on the plan and sections as are necessary for the understanding of the following.



Part Diagram Plan

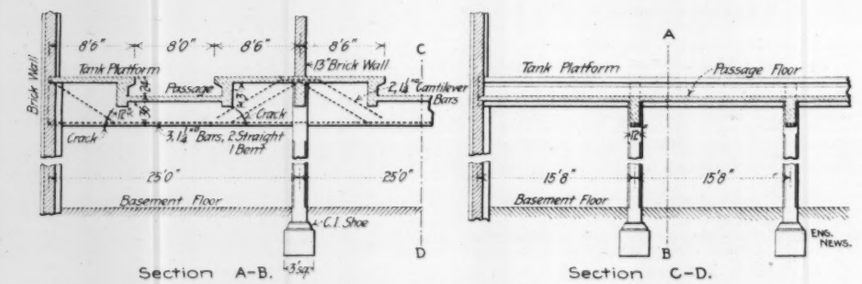



FIG. 1. PLAN AND SECTIONS OF TANK HOUSE AS ORIGINALLY DESIGNED AND BUILT.

The raised portion of the floor supported tanks, one row either side of the depressed passage. When the tanks were filled cracks developed in the main girders, in the bottom, below the reentrant angles. The 12 × 36-in. beams also showed weakness in a number of cases.

The main trouble in this building was the large cracks in the main girders. It is stated that some of these cracks opened up with a loud report while the tanks were being filled, while other cracks developed slowly and gradually. The cracks were most pronounced in the end bays, but cracks were also found in the intermediate girders, although of less extent. It is claimed that a test load had been put on the floor without signs of distress being discovered, but no record of the magnitude or extent of this test load is available.

The design of the main girders seems to show that some degree of continuity had been depended upon to reduce the tension in the main tension bars. A computation of the distribution of stresses under this assumption would be a difficult matter, though not entirely impossible, on account of the varying depth and moment of inertia of the girder. Furthermore, no very definite idea could be had as to the distribution of loads, as the tanks in one compartment might be full and those in the adjacent one empty, in which case the tensile and compressive stresses in the span considered would reach their absolute maximum, while the columns would be subject to a bending moment which could not be entirely disregarded.

In any case the wall end of the end spans would act very nearly as if simply supported only, no dependence being had upon the restraining action of the walls. In the central spans, however, under normal conditions a certain allowance could safely be made for continuity over the supports.

At the time of this investigation, however, it was found that the brick partition walls of the upper story were badly cracked in a diagonal direction, which was taken as an indication of settlement in the foundations. The direction of the cracks was such as to indicate a settlement of the interior footings in relation to the exterior construction, which latter rested on a continuous footing under the wall. A calculation of the pressure on the soil under the column footings gave an intensity of pressure of nearly 13 tons per sq. ft. The footings were 3 ft. square and, supposedly, rested on a shale bed. This pressure is rather high, in view of the fact that the local building code allows only 8 tons per sq. ft., but it is conceded that no settlement would ordinarily take place in shale under this pressure. Different theories were advanced by those responsible for the condition of the building in order to account for the cracks in the brick walls. When the footings were finally excavated it was found that out of the entire number of footings only three rested on the shale, the balance having a layer of clay of varying thickness under them. No explanation of this fact has been offered, but it fully explains the settlement of the interior footings. The wall footings were found to rest on shale and they could therefore not follow the settlement of the rest of the structure.

Under these circumstances it becomes unnecessary to go into the details of the stresses in the girders when considered as continuous over the supports, since the settlement of the footings makes such a condition impossible. Considering the girder as simply supported, the bending moment under full load becomes 2,065 inch-tons. The depth of girder at the center of the span is 36 ins., or probably 34 ins. from top of girder to center of steel; the effective depth of girder would then be about $0.89 \times 34 = 30$ ins., and the maximum total pull in the steel could not be less than $2{,}065 \div 30 = 69$ tons. The tension reinforcement is three 1¼-in. plain square bars having an aggregate cross-section of 4.68 sq. ins. This gives a stress in the steel bars of not less than 29,400 lbs. per sq. in. The building code of the city allows a maximum of 16,000 lbs. per sq. in. for plain bars, and this intensity of stress certainly should be a maximum in cases where the condi[illegible] as to load and general arrangement are as [illegible]ptional as here.

The main tension bars, of which [illegible] was bent and two were straight, had no p[illegible] on to prevent their sliding, the bars being [illegible] straight at the ends without any hook. [illegible] the columns the ends merely butted, no [illegible] ing called for on the plans. The cracks [illegible] may be considered as due to a sliding [illegible] bars in the concrete, and this theory is [illegible] ported by the fact that some of the girders [illegible] d with a loud report. That the floor did [illegible] ome down entirely might be attributed to [illegible] frictional resistance, which is considerable. [illegible]esides, no more load was put on after the [illegible]s had developed, and the tanks were part[illegible]mptied as soon as practicable.

STRENGTHENING THE STRU[illegible]URE.—The next question to present itself was [illegible] what extent and in what way the buildi[illegible] should be strengthened so as to carry safely [illegible] load for which it was designed. There is [illegible] reason to doubt that the girders still had [illegible] carrying capacity, but on account of the sli[illegible]ding of the bars it was considered impossible to predict with safety just what would be a safe load. For this reason it was decided to build [illegible] girders capable of sustaining the entire dead and live load. The footings, of course, had to be enlarged and brought down to shale foundation. It was found impracticable to do this work without introducing new columns, so that the repair work required entirely new supporting members, which had to be put in without interfering with the running of the factory.

In the meantime a number of the floor beams (15 ft. 8 ins. span) had also shown signs of weakness, although an examination of the plans had failed to show any fundamental errors in their design. These cracks may have been caused by the unequal settlement of the footings, or by misplacing of the rods in the beams. At any rate, in submitting a tentative sketch for repairing the building the writer deemed it wise to try to reduce the span of these beams, thereby reducing the stresses, for which reason a T-beam section was suggested for the new girders. (Sketch A, in Fig. 2.)

The original designers of the building had admitted their responsibility, as they had also had charge of the inspection of the work. They suggested a scheme which would give practically the same clear distance between columns as before, and after some modifications a scheme was developed which was finally adopted by the owners, and of which details are shown in sketch B, Fig. 2. The main objections to this scheme are the very heavy compression bars and the absence of any extra support for the floor-beams. Special repairs were made on these where needed, which would have been avoided if the T-section girder scheme had been adopted. Financial reasons which could not be disregarded made it desirable for the owners to accept the scheme submitted by the original designers.

The repair work was now carried on as fast as possible, a section of the building being taken at a time, while the balance of the building was used for manufacturing purposes. Canvas curtains were used for temporary partitions between the sections and all dust was at once sprinkled to keep it from entering the other parts of the building. The repair work required 275 cu. yds. of concrete, which cost approximately $6,000, making the unit cost of finished concrete about $22 per cu. yd.

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THE PRODUCTION OF COAL GAS in the United States in 1907, as reported to the U. S. Geological Survey, was 58,096,478,402 cu. ft. Reports were received from 513 companies operating coal gas works and by-product coke works. The net product sold was 54,696,797,893 cu. ft., the remainder being lost through leakage, fire, etc. The average value was 66 cts. per thousand cu. ft. These figures show, compared with those of 1905, an increase of 14,242,582,761 cu. ft. in the quantity of gas sold and a decrease of 1.4 cts. per thousand cu. ft. in the price. Pennsylvania in 1907 superseded New York as greatest producer and consumer of coal gas.

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## SPECIFICATIONS AND NOTES ON MACADAM ROAD CONSTRUCTION.*

By A. N. JOHNSON,† Assoc. M. Am. Soc. C. E.

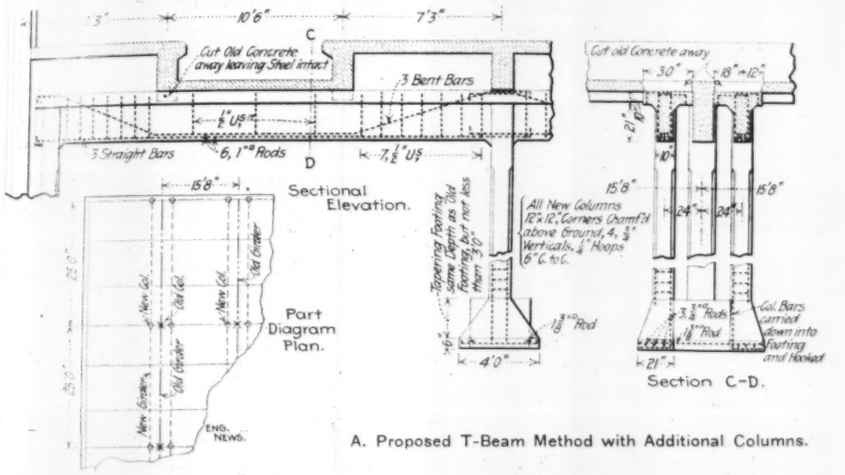
The writer appreciates fully the difficulty of preparing any good specification that would be of real service in specific instances. Such a difficulty exists no less in specifications for macadam road work than in any other line of engineering.

It is not out of place to say a word in general regarding specification. There is often a great temptation to draw a too rigid specification. In this connection, Dr. Charles B. Dudley in his address before the American Society for Testing Materials in 1903, well expresses the penalty one pays for an over strict specification, as follows:

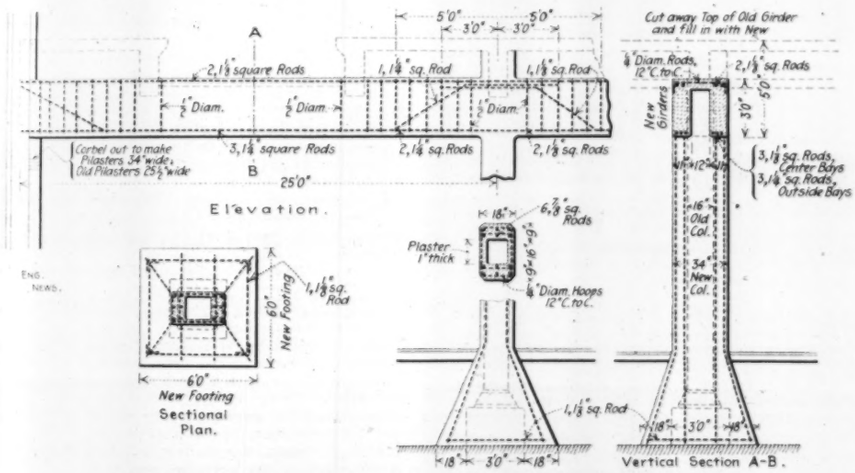
> Excessively severe limitations in a specification are suicidal. They lead to constant demands for concessions, which must be made if work is to be kept going, or to more or less successful efforts at evasion. Better a few moderate requirements rigidly enforced than a mass of excessive limitations which are difficult of enforcement, and which lead to constant friction and sometimes to deception.

On the other hand, specifications should not be too lax and leave too much to the "opinion of the engineer." It is generally conceded that a good rule for specifications is to tell only what is wanted, and no more, leaving the method of arriving at the result to the discretion of the contractor. This is undoubtedly a good rule but does not cover all contingencies. Actual experience in road building, for example, has shown the wisdom of prescribing in certain parts of the work the method that shall be followed rather than the result. This arises from the fact that while it is a comparatively easy matter to specify precisely what we want, which would be, let us say, a road with a smooth surface, properly graded, comfortable to travel, and which should show no signs of depressions or other inequalities under traffic at any time of the year, yet it is impossible to say from its appearance after the road is built whether it will fulfill our specification or not, except as time may develop the good or bad qualities of the work. We might, of course, require that the road show no signs of failure for a stated period, assuming that if it withstood the action of traffic and weather conditions for two or three years that it would be fair to assume it would withstand them successfully from that time on.

Such a plan, however, would withhold from the contractor such an amount of money as would be a very considerable inconvenience and expense even if this method could be justified on other grounds. But this procedure is not necessary. Experience has shown that if certain methods of construction are followed we are reasonably assured as to the results. It has, therefore, been found a better practice to limit the contractor as to the methods he shall employ, and release him from obligation as to the results. This latter condition is not always considered, and one sometimes finds specifications which provide not only as to the exact methods the contractor must follow, but at the same time put an obligation upon him if a failure of any part of the work ensues. Such specifications are evidently unskillfully drawn as they can seldom be enforced at law, and are more or less evidence of the engineer's distrust of his own design and specifications.


Cut Old Concrete away leaving Shell intact
3 Bent Bars
3 Straight Bars
6, 1" ⌀ Rods
Sectional Elevation.
Part Diagram Plan.
Cut old Concrete away
All New Columns 12"x12" Corners Chamf'd
Tapering Footing same Depth as Old Footing, but not less than 3'0"
1⅛" ⌀ Rod
Col. Bars carried down into Footing and Hooked
Section C-D.
ENG. NEWS.

A. Proposed T-Beam Method with Additional Columns.


2, 1⅛" square Rods
1, 1⅛" sq. Rod
½" Diam.
Corbel out to make Pilasters 34" wide; Old Pilasters 25½" wide
3, 1⅛" square Rods
2, 1⅛" sq. Rods
25'0"
Elevation.
Cut away Top of Old Girder and Fill in with New
⅞" Diam. Rods, 12" C. to C.
New Girders
3, 1⅛" sq. Rods, Center Bays
3, 1⅛" sq. Rods, Outside Bays
6, ⅞" sq. Rods
Plaster 1" thick
⅝" Diam. Hoops 12" C. to C.
16" Old Col.
34" New Col.
1, 1⅛" sq. Rod
New Footing
6'0"
Sectional Plan.
Vertical Section A-B.
ENG. NEWS.

B. Adopted Method, with New Double Girders and Enlarged Columns.

FIG. 2. METHOD OF STRENGTHENING THE STRUCTURE.

Before we pass to the detailed consideration of our subject, a word should be said regarding the influence of modern traffic conditions on the methods of road building. In situations where but a few years ago there would be no doubt as to the efficiency and advisability of ordinary macadam construction, there is to-day much uncertainty in the minds of most highway engineers as to what is best. This change has been brought about by the increase in motor vehicle traffic, and has attracted the world-wide attention and study of road builders.

There does not seem to be any question but that it is impossible to maintain in good condition an ordinary macadam road subjected to any large amount of motor traffic. It is only by applying some tough, elastic binder in the top or wearing course of the road that a macadam surface can successfully resist this traffic. The present practice is generally to use for this purpose either a coal tar or an asphalt compound. Sufficient experience, however, has not been had to determine definitely what will prove best. Although considerable knowledge has been gained in the methods of application, the test of time is yet to prove the relative worth of different methods and material. The problem for solution is, can macadam roads that will prove satisfactory and economical under the new traffic conditions be built with only a slight increase in cost? If it is necessary for the preservation of macadam construction to double or treble its cost, we have other kinds of pavement available which are known to be more durable and, if economy is the chief consideration, to be more desirable. But we enter here on the discussion of what kind of a pavement should be used, which, as before stated, is not to be a part of this paper.

There are, however, many miles of road that can be maintained as macadam roads. It also seems probable that where there is but a moderate amount of motor traffic such roads can be maintained by a comparatively inexpensive treatment which will insure a durable road surface at an expense not incommensurate with the worth of the road to the public. But we should keep in mind that even though our road to-day has but little or no motor traffic, it probably will have more, rather than less, so that our method of construction, wherever we can do so economically, should be changed to meet such a condition. The specifications and suggestions made here have been drawn with this idea in view.

### Specifications.

#### ROAD BED.

The road bed will be considered as that portion of the road upon which broken stone is to be placed. The road bed is to consist of the natural earth which has been brought to the proper elevation and cross sections and rolled by a steam roller until firm and hard.

If sandy or other soil be encountered which will not compact readily under the roller, a small amount of clay or other means shall be used until a firm, hard surface is obtained after rolling.

Note.—The width of broken stone to accommodate the traffic ordinarily found on roads in agricultural sections of the country does not need to be over 12 ft. Here the traffic consists of wagons following one another, so that even where a greater width has been provided it has been found that the travel is confined to a single track so that the extra width has been built to no practical purpose.

It is often contended that 12 ft. is not sufficient room for wagons to pass. This is true for some kinds of wagons. It is, however, usually a fact that the loaded wagons are all moving in the same direction at a given time in the day, so that the chances are that at least one of the wagons meeting will be unloaded and could turn out with little inconvenience, even in the worst weather. Inasmuch as this will happen but occasionally, the side of the road or shoulders will not be cut up. Serious inconvenience is experienced, however, in the immediate neighborhood of a town where residences may be or are in immediate prospect of being built alongside the road, which will occasion much repassing of light vehicles. If a sufficient width of macadam is to be provided where passing is frequent, not less than 18 ft. is required.

Where the traffic consists of much pleasure driving, a width of not less than 16 ft. should be made. Roadways that accommodate an amount of motor traffic, that necessitates frequent passing, should be not less than 18 ft.; in fact, it would seem that due regard for safety would make the minimum width 24 ft.

With the large mileage of unimproved roads, and the small amount of money available for their improvement in most communities, it is important at first to build as great a mileage as possible; to which end the narrowest road practicable should be built. But not less than 12 ft. is to be advised, for, if the traffic can be so directed, this is sufficient space for it to spread so as not to bring all the wear in one track. Roads 8 ft. wide have been built and found a failure because of the fact that the traffic was confined to one track, so that the road actually wore faster and became more expensive to maintain than a wider road where the traffic had room enough to spread about and not bring all the wear in a particular place.

On the construction of the roadbed hinges the success of the road covering. The roadbed must be firm and shaped true to the cross section. Uneven places in the roadbed invariably appear in the surface of the finished road. When there is evidence of underground water, as shown by seepy or quaky places, there is but one remedy, and that is to remove the water by tile under drainage. Unless this is done the macadam is sure to cut through as the frost comes out of the ground. The most treacherous places will usually be found on the hillsides, and careful inspection should be made of all such places for signs of underground water. The fact that a road surface becomes deep with mud in wet weather does not necessarily show that under drainage is needed. In fact, on most of the level prairie roads it is not needed, but it is sometimes the most efficient way to take care of troublesome surface water. The essential thing to accomplish under such circumstances is to place the roadbed at a sufficient elevation to raise it above the surface water that may stand in the ditches at the roadside.

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* A paper read before the Western Society of Engineers, Oct. 21, 1908.

† Highway Engineer, Springfield, Ill. (Formerly Engineer for the Maryland Highway Commission.)

### THICKNESS OF MACADAM.

The thickness of macadam to be used at any particular point shall be that as shown on the plans or as indicated in writing by the engineer. In general, there shall be three classes of macadam, known as 6-in., 8-in., and 10-in. construction. The thickness in each instance is to be that of the road after thoroughly compacting by rolling and completed in accordance with the specifications herein contained. The thickness, after rolling, of the various courses in each class is to be as follows:

| Class. | 1st Course. | 2d Course. | 3d Course. |
|---|---|---|---|
| 6-inch | 4 inches | 2 inches | To be as |
| 8-inch | 5 inches | 3 inches | hereinafter |
| 10-inch | 6 inches | 4 inches | described |

Each course of broken stone is to be applied as herein specified.

Note.—The chief factor governing the thickness for a macadam road is the nature of the soil in the roadbed. Where the soil does not change it would not be necessary to indicate more than one thickness. Otherwise, a careful examination of the roads is necessary, and the thickness determined for each section should be indicated on the plan. Experience has demonstrated that a thickness from 8 to 10 ins. is ample under any condition where a road can be maintained. If this thickness does not prove sufficient, it is evidence of an improper foundation, and the remedy must be sought there. The usual trouble is lack of proper under drainage. Where this is provided there need not be any excessive thickness of road covering. It has been the writer's practice on clay and other retentive soils to make about an 8-in. road; that is, the stone is spread in two layers of about 5 ins. each, which after rolling reduces to about 8 or 8½ ins. in thickness. On sandy soils, or soils containing a considerable percentage of sand, which are more or less porous, and where there is perfect under drainage, 6 ins. of macadam has been found to be ample; the 6 ins. being the thickness after the necessary rolling. It would require about 8 to 8½ ins. of road material. The nature of the material also affects to some extent the amount of material that would be placed for road covering. Where soft limestone has to be used and the wear is consequently faster, it is better to provide an extra thickness of material.

### CROSS-SLOPE.

The cross-slope for the roadbed is to be as shown on the accompanying plans, and is to have a slope of— inches to one foot.

Note.—The amount of cross-slope or crown to be given to a road is a matter of considerable difference of opinion among road builders. In general, it may be said that on a much traveled road, if the traffic is distributed, the amount of cross-slope need be less than on one lightly traveled, also the harder the material the less the slope. As much slope should be given on level stretches as on steeper grades.

In some works on road construction the rule is laid down that the cross-slope should be steeper on high grades than on level stretches, so that the water will not follow for any considerable distance in the direction of the road, but reach the gutter sooner than would be the case with less cross-slope. While it is true that a cross-slope should be maintained on high grades so that the water will be carried as quickly as possible into the gutters, it is essential that the road have an equally steep cross-slope or crown on level stretches from the fact that in these places if a slight rut forms the only outlet the water has is crosswise of the road. Where the crown is flat a very slight depression will be sufficient to keep the water on the road. These puddles of water will soften the surface, and a hole will soon be formed which will become deeper and larger at every rainfall, so that quite as bad an effect is produced as would be the case if an insufficient crown were used on a steep grade. The theory that the cross-slope should be more on steep grades is correct for a theoretical road surface, but in practice these theoretic conditions are not fulfilled, and the conclusions drawn therefrom will not meet practical requirements. Generally the best results will be obtained on country roads with a cross-slope of 1 in. to 1 ft., this to apply to a width of macadam up to 15 ft. Between 15 and 20 ft. the slope should vary from 1 in. to 1 ft. at the sides to ¾-in. for the center half of the roadway. Not less than ⅝-in. to the foot should be given to a macadam surface.

### TELFORD CONSTRUCTION.

Telford construction is to be used wherever directed by the engineer or provided for in the plans. The width required at different points is to be that designated by the engineer.

Note.—Telford construction is much less used to-day than formerly. Nearly all of the old turnpikes in this country were constructed with a foundation of large stones. More recently some telford construction has been laid, particularly in New Jersey. In the best modern practice, the telford foundation finds little favor. Quite as efficient, and a much more economical construction, is effected by a layer of gravel or broken stone whenever the character of the foundation requires an extra thick road covering. It is a mistake, however, to suppose that a more stable foundation is secured by placing the large pieces at the bottom of a road covering. In case there should be any frost disturbance and consequent movement of the materials forming road covering there is always a tendency for the larger pieces to work to the surface, whereas if a layer of material is placed with the smaller particles at the bottom, subsequent disturbances from any cause will result in little or no readjustment of the relative positions of the particles.

As a telford foundation is usually expensive and exceedingly difficult to have laid properly, and does not prove practically more efficient than a cheaper form of construction, there is little excuse for using it.

The following specifications will illustrate the details of this form of construction.

### MATERIAL.

The first course of the telford construction is to consist of sound stone with sharp corners broken to the following dimensions: Depth, from 5 to 8 ins.; width, from 3 to 6 ins., and length not exceeding 16 ins.

### LAYING.

Broken stone for the first course of the telford construction is not to be laid before the roadbed has been made as specified. The pieces of stone are to be set by hand on edge and laid close together lengthwise across the road resting on the broadest edge. Protruding corners are to be broken off and the interstices filled with small pieces.

### ROLLING.

After the stone for the first course has been laid and brought to a proper cross-section, the spaces filled with spalls and the layer made as compact as possible, it is to be rolled with a steam roller weighing not less than ten tons. The interstices must not be filled with earth.

### UNEVENNESS OR DEPRESSIONS.

Should any unevenness or depressions occur during or after the rolling of the first course, they are to be remedied immediately by broken stone and rolled firm.

### THICKNESS.

The thickness of the first course for telford construction is to be 8 ins. when finished.

### FIRST COURSE FOR MACADAM CONSTRUCTION.

Macadam construction is to be used wherever directed by the engineer or provided for in the plans. The width required at different points is to be that shown on the plans.

### MATERIAL.

The first course of macadam construction is to consist of sound stone broken to sizes varying from ¾-in. to 1½ ins., no piece to have a diameter greater than 1½ ins.

No material is to be used which, in the opinion of the engineer, is unfit for the work. If any such material is put upon the road it shall be removed immediately upon notice from the engineer, and replaced by proper material at the contractor's expense.

Note.—It is not necessary that the first or lower course of a macadam road should be of the hardest or toughest material. The purpose of the lower course is to distribute the weight of the traffic over the earth foundation, so that wherever it happens that tough material suitable for a good wearing course is remote from the place of construction, and consequently higher in price than more accessible material which is not so good, economy can be effected by using the poorer local material in the foundation course, applying the better material to the upper course only. A quality of gravel that would not make a good road surface may be used in the first course; likewise burned shale; in fact, any comparatively non-absorbent, enduring material broken to a suitable size.

### SPREADING.

No broken stone is to be spread before the roadbed has been made as specified.

The broken stone is to be spread upon the roadbed, prepared as herein described, with shovels, from piles alongside the road or from a dumping board, or it may be spread directly from wagons specially constructed for this purpose and approved by the engineer; but in no case shall the broken stone be dumped directly upon the roadbed.

As soon as spread, the layer of stone is to be thoroughly raked or harrowed with a tooth harrow, and finally trimmed true to the shape of the cross-section.

Note.—It is a well known fact that a mass of various sized pieces of stone adjusts itself when stirred or raked so that the smallest sized particles are at the bottom and the largest at the top. When this condition is attained, we have what may be called a stable equilibrium of the particles relative to one another.

Therefore, if we rake thoroughly a layer of stone, we shall adjust the pieces so as best to resist any disturbing force. As the roller goes over a layer of material thus assorted it tends to compact much more readily, as the larger pieces do not attempt to work their way through the road surface. The arrangement often seen represented in cross sections, showing the largest pieces at the bottom and the smallest on top, is a reversal of what it should be. The stability of such a mass of material may be compared to that of a pyramid resting on its apex.

It will be readily appreciated that if the pieces of rock forming a road surface have been well compacted, even though the smaller pieces are at the top, there will not be any relative movement of the pieces of stone, except that they are loosened, which will happen when frost is coming out of a badly drained road. Where such places are encountered, and there are many instances of roads practically impossible to drain properly, the road surface can be maintained much more nearly intact, if the pieces of stone are arranged with the smallest at the bottom.

But it is not sufficient merely to have a layer of the smaller screened stones as a bottom course and a layer of larger size on top. In the smaller size are pieces varying from ¾ to 1½ or 2 ins., according to the size of the screen. It is then desirable that [illegible] sible all of the 2-in. size be at the top [illegible] arranged in this order down to the [illegible]

This arrangement can be effected [illegible] practical purposes by thoroughly rak[illegible] the layer of stone after it is spread.

There is another object attained by [illegible] has always been recognized as most [illegible] construction of macadam roads, and t[illegible] surface composed of as nearly equal [illegible] possible. As a macadam road surface [illegible] ous sized pieces begins to show wear, it [illegible] the largest pieces of rock protrude, pr[illegible] surface.

The fact that the larger the pieces of [illegible] resistant is the road surface to the ac[illegible] another reason for having the larger pi[illegible] face. There is, however, a practical li[illegible] of the pieces of rock for macadam co[illegible] ing somewhat according to the hardness [illegible] character of the traffic. The soft li[illegible] screened through a 3½-in. screen and u[illegible] for the surface. Many hard rocks, as [illegible] granite, cannot be used so large, a 2½-[illegible] the largest, unless subjected to very he[illegible] is, traffic made up of heavily loaded wa[illegible]

It has also been observed that a road surface composed of small pieces of stone deteriorates much more rapidly under action of automobile traffic than when built of larger sizes. While the writer cannot offer exhaustive evidence on this point, all of his observation confirms this opinion.

To sum up what is gained by using the smaller pieces of rock in a layer at the bottom and the largest at the top, we have a more stable road, a more even, and a more durable surface.

### ROLLING.

After the broken stone for the first course has been spread and raked or harrowed to a uniform thickness, and has a proper cross-section, it is to be rolled with a steam roller, weighing not less than ten tons, until it is compacted to form a firm, smooth surface. The rolling must begin at the sides and work towards the center and the rear wheels of the roller must cover this space thoroughly.

Note.—The strength of a stone or macadam road depends entirely upon the rigidity with which one piece of stone is held against its neighbors. The roller presses the piece of stone close together so that instead of having a contact of but one point or one edge with a face, the faces of the pieces of stone are brought together and the voids as they exist in the loose material are reduced from 45% or 50% to about 20%.

It is bad practice to fill in the voids in the stone with fine material before rolling, as it prevents the pieces of stone being keyed firmly in place.

There does not appear to be any valid reason for filling or bonding the lower course of material at all, and is so much work wasted. A roller should be run slowly, not over two miles an hour. The slower the roller is run, the more firmly are the stones compacted. It is possible to run a roller so as to tear a layer of stones to pieces.

### UNEVENNESS OR DEPRESSIONS.

Should any unevenness or depressions appear during or after the rolling of the first course, they are to be filled immediately with broken stone and rerolled until a firm, even surface is obtained.

Note.—A depression in a layer of macadam should be filled with material of the same kind and size as that composing the layer. If a patch of small material should be added to bring up the surface composed of large pieces, the small pieces would be ground under traffic, and the depression would again appear. The proper way is to loosen the surface in the depression, add extra material of the same size, and re-roll.

### THICKNESS.

The thickness of the first course of broken stone, after thorough rolling, is to be that of the class of macadam construction specified for any particular place as described.

If, for any reason, a greater thickness than specified is made by the contractor, no extra allowance for such additional thickness will be made.

### SHOULDERS.

After the telford foundation or the first course of broken stone or gravel, as the case may be, has been made as herein described, earth shoulders are to be constructed along each side of the road for a width of at least 4 ft., as shown on the accompanying plans.

Against these shoulders is to be spread the broken stone for the second course as herein described. The shoulders are to contain a sufficient quantity of earth so that a smooth and continuous slope will be obtained after the shoulders and second course are rolled. The shoulders with the ..... feet of stone will make a total width of ..... feet to be shaped with a cross-slope of ..... inches ..... to 1 ft.

Material for the shoulders must be free from roots, stumps or other vegetable matter and thoroughly compacted by the roller. Material with such a proportion of sand, as prevents it, when dry, from compacting readily under the roller, is not to be used.

No material which is considered unfit for the work by the engineer is to be used, and, where any such is put on the work it shall be immediately removed at the contractor's expense, upon notice by the engineer.

Note.—It is important to have the material for the shoulders put in place as soon as the first course is made, as the shoulders are depended upon to hold the second course of material in place. The shoulders should be

shaped before they are rolled, so that they will be, depending on the nature of the material, from 2 to 3 ins. higher than the second course of broken stone; and when they are rolled they will press down even with the surface of the broken stone. As the work progresses, the engineer will find that it is necessary to keep the shoulders above the level of the stone so that they will roll down properly, which is very readily ascertained. If it is found that not enough material has been used, more must be spread until the shoulders are brought to a proper shape. If the roadway for the new road has been cut sufficiently deep, it will not be necessary to fill in extra material for the shoulders. Where the shoulders are thus made, by cutting out, it is advisable to leave them a little higher at first, and then pare them down with a road machine. After a little experience a good operator can trim the shoulders very accurately by this method.

An excellent plan is to sow the shoulders with grass seed. The sod forms a good protection to the shoulders, besides adding much to the appearance of the road.

### BLIND CROSS DRAINS.

Blind cross drains are to be constructed at intervals of 50 ft. on each side of the road in the following manner: They shall run approximately at right angles to the direction of the road and shall be cut to a sufficient depth so that the water can readily run from the surface of the subgrade to the side of the road. They shall not be less than 8 ins. in width. These drains are to be shaped just before spreading the first course of material and are to be filled with broken stone. These cross drains are to extend to the gutter. The stone in the cross drains shall come within 3 ins. of the finished surface of the shoulder.

Note.—The blind cross drains are necessary wherever the shoulders are made of an impervious material. These cross drains are particularly useful on level stretches of the road where satisfactory longitudinal drainage is difficult to secure. Roads constructed through lowlands, which may be submerged by occasional floods, should be well provided with these blind side drains. In such instances they should be put in at intervals of about 30 ft. The pitch or grade to these drains should be the most that can be obtained from the surface of the subgrade to the bottom of the gutter. They also serve to keep the shoulder well drained, and consequently firmer in wet weather. The side drains are especially useful during construction to drain the roadbed rapidly after a rain, which easily penetrates the loosely spread material, and softens the subgrade so that work has to be abandoned on that section until it dries out.

## SECOND COURSE FOR MACADAM CONSTRUCTION.

The second course of the macadam construction is to be the same width as the first course.

### MATERIAL.

The second course is to consist of stone broken to size varying from 1½ to 3 ins.; no piece to have a greater diameter than 3 ins.

Unless otherwise specified, the rock shall have a "coefficient of wear," as determined by the Duval test, of not less than 15.

Note.—It should be borne in mind that the second course, or the course covering the foundation of either macadam or telford construction, is the one which must receive the wear from the traffic. The foundation course merely gives the thickness so that the pressure of traffic may be distributed over the natural earth roadbed, which supports the road surface. Therefore, in making specifications for the second course of material, its purpose should be kept constantly in mind. Inasmuch as the wear due to the traffic is dependent on so many different conditions, it will be natural to expect that which is best in one instance may not prove equally successful in other cases.

The wear due to traffic is of two kinds: That of horses' hoofs, and that from the grinding of wheels. These produce different effects on broken stone roads. Where the traffic is very heavy; that is, where the weight upon the wheels is great, their pressure tends to compact the stone firmly, which if it is not of sufficient strength, will be crushed and ground to dust. On the other hand, where the kind of traffic is lighter, with wheel pressure comparatively small, there is but little grinding or compression. Generally this lighter traffic moves more swiftly so that the effect produced by the horses' hoofs is much more noticeable. The hoofs of a fast running horse hit the road with a quick, hard blow, which has the effect of loosening the particles of broken stone. As there is little compression given by the wheels in this class of traffic, the loosened pieces of stone are not pushed back into place, and this results in what is known as "raveling."

The action of motor vehicle traffic on a macadam surface is far more destructive than any other to which our roads are subjected. Careful observations made by the Office of Public Roads at Washington show that the destructive action is almost wholly due to the driving wheels. The scour or shear on the road surface that is produced when heavy cars are driven at high speed is sufficient to displace the surface particles of the road which are sucked up and dispersed in clouds of dust. The stones in the upper portion of the road are bared and, in time, loosened. The surface of the road, particularly in dry weather, becomes covered with pieces of loosened stone.

Experience has shown that different varieties of stone act differently under traffic. Thus, some varieties will make a hard, firm road if there are many vehicles moving over the road; while other varieties are found to be quickly ground into dust under similar conditions but give good results where the traffic is lighter. The heavy traffic is found to require a hard, tough stone, with a high power of resistance to wear, and which it will require great force to split. There are few varieties of rock which have these physical properties that are not adapted for the surface of a macadam road which will be subjected to a large amount of heavy traffic. Such traffic is not usually found on the majority of country roads, or, if found, there is seldom a sufficient amount of it to keep the hardest varieties of stone in place unless they have a third physical property, that of binding readily. Such stone when ground to dust will cement together, and this property is called its cementing value. If this property is wanting or exists only to a slight degree in a rock, it will be found practically useless to supply such material to the ordinary country road. And in proportion as the traffic over one road is lighter in character than that of another, so too should the cementing value of the material used in the former case exceed that used in the road with heavier traffic.

The road builder is often confronted with the problem of how best to use a comparatively soft material under conditions which require the hardest variety of rock, or at least where such rock could be used to advantage. The same material can produce under the same conditions quite different results according to the way it is handled. For example, the amount of wear which a road can sustain can be greatly increased by a change in the size of the pieces of broken stone which make up the second or wearing course of the road. A soft limestone or other variety of rock having a low resistance to wear should be broken in larger pieces than would be used with harder material; that is, the second or wearing course should consist of the larger sizes which are larger for softer varieties of stone than for harder varieties. A soft variety of rock used to best advantage may make as durable a road as a harder variety of material improperly used.

It is, therefore, advised that all rocks which have high cementing value but small resistance to wear (that is, having the coefficient according to the Duval test of less than 10), should have the 2 and 3-in. pieces placed in the second course. The sizes permitted may be slightly larger in all courses for rocks with high cementing value and low wearing qualities. Thus, the crusher could be opened wider and more material put through in a given time, which would cheapen its cost, and, therefore, in a measure offset the additional cost of maintenance, which might be necessary where a rather soft variety of rock was used with a moderately heavy traffic.

The fact that pieces of rock from 2 to 3 ins. in size will lock or key together more firmly than 1-in. size makes a surface composed of the larger sizes resist more effectively the action of automobile traffic. In many instances observed by the writer it has been noticed that the first place to give way has been where there evidently has been a cluster of finer particles.

Reference has been made to the Duval and other tests of road material. It is, perhaps, sufficient here to say that a full description and discussion of the tests are found in the bulletins of the Office of Public Roads, Washington, D. C., which may be had on application. The road builder is, however, not often given an opportunity to make much of a selection of materials; he must use what is at hand and make the best of it; so that there is but a limited field of application for the deductions from the refined methods of the laboratory. But even with a single source of material, it is valuable to have thorough laboratory tests made, which should be compared carefully with the practical service tests, as it is only by such comparisons that intelligent interpretation of the laboratory results are possible. Occasional tests will detect any variation in the rock used; they also give valuable information as to what part of a quarry, not uniform in its rock, yields the best material for this service.

### SPREADING.

The broken stone for the second course is not to be spread before the foundation or first course has been completed and shoulders made as herein specified.

The broken stone is to be spread upon the first course, prepared as herein described, with shovels from piles alongside the road or from a dumping board, or it may be spread directly from wagons, especially constructed for this purpose and approved by the engineer; but in no case shall the broken stone be dumped in piles directly upon the first course unless it is entirely rehandled.

As soon as spread, the layer of stone is thoroughly raked or harrowed with a tooth harrow, and finally trimmed true to the shape of the cross-section.

Note.—The object of having the stone spread in the manner specified above is to secure a uniform amount of stone for any given area; so that when compacted by the roller it will compress evenly at all points and no humps will be formed, as will be the case if the stone is dumped in a pile from a wagon and raked outwards in all directions until apparently spread to the required thickness. For in the center of every pile of stone so dumped there is a core formed where the pieces have been more closely jammed together by the weight of other pieces on top of them, so that when the roller passes over the stone there will be formed little mounds wherever these compacted cores were made, which no amount of rolling will efface. It may not be practicable to have the stone dumped at the side of the road or to have a dumping board at hand, and it would then be necessary to permit the second course of stone to be dumped upon the first course, in which case care should be taken to have the pile of stone raked or shoveled over so as to loosen all parts of it equally.

### ROLLING.

After the broken stone for the second course has been spread to a uniform thickness, and has a proper cross-section, it is to be rolled with a steam roller weighing not less than 10 tons until it is compacted to form a firm, smooth surface.

The rolling is to begin at the sides, the shoulders first being rolled firm. When completed the surface of the shoulders and of the second course of broken stone should be smooth and continuous with a cross-slope of ..... inches to 1 foot.

If any unevenness or depressions appear during or after rolling of the second course, either on the surface of the shoulder or the broken stone, suitable material shall be added to remove all such unevenness or depressions, earth being used on the shoulders and stone for the broken stone surface.

### THICKNESS.

The thickness of the second course of broken stone, after thorough rolling, is to be that of the class of macadam construction, specified for any particular place, as described under 6-in., 8-in., and 10-in. macadam. On a telford foundation the thickness shall not be less than 4 ins.

If for any reason a greater thickness than specified is made by the contractor no extra allowance for such additional thickness will be made.

Note.—The second course must be rolled until every particle of stone has been wedged firmly against its neighbors. Satisfactory results cannot be obtained if too great a thickness of stone is rolled at once. Not over 6 ins. measured loose should be attempted. There are many varieties which will not compact readily, and give great trouble in rolling. No specific directions can be given which will prove applicable in every case. If the conditions are such as to make it imperative to use material in which there is considerable mica, it will usually be found necessary to sprinkle it lightly with sand and water to prevent the stone creeping as the roller passes over it. Frequently poor results are caused by attempting to operate the roller at too great a speed, for material which is hard to manage may often be easily handled by reducing the speed of the roller to a rate of about one mile an hour. It may sometimes be necessary, even then, to use a little sand or stone screenings to hold the material in place so that the pieces of stone will be compacted and not grind one another into rounded fragments. But little trouble of this sort is experienced with the softer varieties of rock. The danger in such cases is that the road may be rolled too much. This can be readily told by watching the pieces of stone on the surface; if they are being crushed or broken, the rolling should not be continued. This applies particularly to the softer varieties of limestone.

It is necessary in shaping up whatever uneven places may appear to use material of exactly the same character as that of which the surface is composed. The earth should be filled up with earth, and broken stone with broken stone of the same size. If the depression is so slight that a single thickness of the broken stone is too thick, the way to fill such a depression is to loosen the surface all about it and add a small amount of broken stone, and then roll the whole down. A little experience will soon show about how much higher the loosened portion should be in order to roll down to the required surface.

## THIRD COURSE FOR MACADAM OR TELFORD CONSTRUCTION.

The third course of macadam or telford construction is to consist of rock screenings varying from dust to 1-in. pieces. The screenings are to contain all of the dust.

Note.—If the material of which the screenings are made (which would usually be the same as that of the second course) is extremely hard, that is, has a Duval coefficient of wear of 20% or over, the size of the largest pieces should not be over a half inch. If softer material is used, the screenings may contain pieces as large as one inch in diameter.

The screenings from some varieties of rock are extremely difficult to work properly; that is, they do not seem to bind together and, after rolling, when dried out, loosen and do not hold the surface of the road as it is desired. For example, there are some crystalline limestones, a number of which are found in this state, particularly the stone at the Illinois State Prison used by the State Highway Commission, which do not bind with any facility. The laboratory tests also show it deficient in cementing quality. It is found, however, that when this dust is combined with silica the combination produces a material which binds very much better than either one alone. This fact was observed on roads which had been sprinkled with a light covering of gravel or coarse sand. An investigation in the laboratory combining silica with such limestone dust also showed an increase in cementing power. In all of the construction carried on by the State Highway Commission the past year we have advised,

where the material from the Joliet prison has been used, that it be bonded with a thin layer of fine gravel or very coarse sand; where this has been done the result has been very much more satisfactory than where roads were built using the natural rock screenings alone.

SPREADING SCREENINGS.

After the second course of stone has been rolled and completed as specified, the screenings are to be spread, but in no case are screenings to be used until the second course has been thoroughly rolled and compacted. The screenings are to be spread dry with shovels from piles along the road, or from dumping boards, but in no case are the screenings to be dumped directly on the second course. The quantity of screenings used is to be such as will just cover the second course.

There usually seems to be a strong inclination to put on screenings too thick or too much at one time. The road surface apparently is finished quicker and with less work where a layer of screenings from ¾ to 1½ ins. thick is spread at one time.

Where it is desirable, as on park roads, to have a soft surface, a greater layer of screenings may eventually be placed, as such roads naturally receive or are expected to receive, constant attention, and can thus be maintained in good condition. In general, however, it is a safe rule to use as few screenings as possible. A road with too much screenings will have a deadened sound as vehicles move over it.

WATERING AND ROLLING.

After the screenings are spread they are to be sprinkled with water from a properly constructed sprinkling cart, and then rolled with a steam roller weighing not less than ten tons. The amount of water necessary is to be determined by the engineer. The rolling is to begin at the sides and to continue until the surface is hard and smooth and shows no perceptible tracks from vehicles passing over it.

If, after rolling the screenings, the stone appears at the surface, additional screenings shall be used in such places.

The rolling and watering shall continue until the water flushes to the surface. The rolling is to extend over the whole width of the road including the shoulders.

Note.—The best results are invariably obtained if the screenings are first wet and then rolled. Often it will be impracticable to get a sufficient supply of water to the road for this purpose, in which case the screenings may be spread and the road used as little as possible until a shower does the sprinkling. As soon as it is possible, either during the shower or immediately after, the rolling should be started, and continued until the surface of the road has become practically impervious to water. Where it is necessary for the road to be used as soon as the screenings are spread, and it is impossible to water them, they may be partially rolled dry and then another layer of screenings spread. This excess of screenings will make the road somewhat more dusty or muddy, according to the wet weather, and the surface will require more careful watching than is the case where the screenings are sprinkled before rolling. Care should also be taken not to drench the screenings at first, as the water will go immediately through the loose stone of the road into the foundation, softening it, and rolling will have to be suspended until it dries out. The first sprinkling should, therefore, be light—merely enough to permit the dust to bind or cake together. The screenings should be added a little at a time so that they will fill all interstices thoroughly, but not form a crust on the road, which is liable to disintegrate and peel off. As soon as the interstices are thoroughly filled with the screenings, and consequently made impervious to water, the sprinkling may be heavier than at first. Where the roadbed is on a gravelly or sandy soil which is naturally well drained, but little damage will result from copious sprinkling; but where the roadbed is on a clay soil care must be exercised if the foundation is to be kept firm enough to support the roller without jamming the broken stone into the earth, which would result in an uneven place in the road-surface.

UNEVENNESS AND DEPRESSIONS.

If any unevenness or depressions appear in the road surface after rolling the screenings, broken stone and screenings shall be used until they are removed and the finished surface conforms to the proper cross-section, as shown on the accompanying plans, and presents a smooth, even appearance.

Note.—The following directions concerning the application of screenings were prepared by the writer for the use in the work of the Illinois Highway Commission:

Screenings must not be dumped directly on the broken stone but must invariably be placed at one side of the roadway.

The shoulders must be shaped and rolled for two or three feet from the edge of the stone, the surplus earth then being graded off towards the gutter and the shoulders re-rolled, not less than 5 ft. where conditions will permit. This will make a firm, smooth space on which to deposit the loads of screenings.

The last course of stone must be thoroughly rolled until the stone has compacted, and each piece is in contact firmly so that the stone does not jar or move when wagons go over it. When the stone is thus firmly packed, the screenings are to be spread, not by shovelfuls in a place, but by having each shovelful spread parallel with the road from a square point shovel over the greatest area possible. The first application should be just enough to fill the interstices between the stones. The screenings should then be very lightly sprinkled. Where the screenings have been washed down between the stones, a very light additional layer of screenings should be put on. Then have the roller pass over the work, beginning at the edges and working towards the center, once over every part. Where necessary, add more screenings and again roll.

If a gravel binder is used, see that the screenings fill the interstices only partly, then spread on some of the gravel binder. After the first rolling, put on where necessary more binder, and then sprinkle lightly.

The screenings or binder, after this sprinkling, may stick to the wheels, and it is better, therefore, to do this sprinkling the last thing at night, and roll the road in the morning. After this rolling, and adding what binder may be necessary here and there, the road will probably be sufficiently water-tight, so that more water and binder may be added. As soon as the road becomes water-tight it should be well sprinkled, if possible, having the water play on the roller wheels. The screenings or binder must be placed on the road and that part of the road finished immediately and traffic blocked off until the road has taken on a set.

Unless the work is done in this way, it will be found that the road when partly screened, and travel allowed to go upon it, will become loosened. The screenings will get between the stones and entirely surround many of the pieces of stone in the top of the road. Where this happens, it will be found that they will easily pick out. This explains why it is that we find occasionally patches here and there where the stone picks out readily after we have finished the road.

Travel over broken stone before the screenings are added does no particular harm, but screenings must not be put on crushed stone that is loose, and after screenings are placed, that part of the work must be finished immediately before allowing any other travel to come upon it.

PRICE PAID FOR MACADAM OR TELFORD CONSTRUCTION.

The price herein agreed upon to be paid for macadam or telford construction is to include all work and materials necessary to do the work as herein specified.

Note.—There are two methods of payment for macadam work in general use. One is by the cubic yard or ton for broken stone; the other by the square yard or unit of surface of finished road of a given thickness. The advantages of the unit quantity method—that is, payment by the cubic yard or ton of broken stone used, are payment for material actually used, and no inducement for the contractor to skimp the work. The advantages of payment by the unit surface measurement are ease of ascertaining the amount of work to be paid for, and the throwing of all responsibility for improper construction of the roadbed upon the contractor, who must supply at his own expense any extra material that may be necessary to bring the road to a proper surface through any lack of care in the construction of any portion of the road.

By either method, careful supervision is important though it is not so necessary to have an inspector as constantly on the work when paid for by the surface unit as by the quantity unit. In the latter instance some one must be at hand to note every load of stone which is placed on the road, and to see that every load of stone credited to the contractor is actually employed on the work.

On the other hand, by the unit surface measurement method, it is necessary to be on the constant watch to see that an unscrupulous contractor does not put in a less amount of material than the specifications require. There is, however, a very good safeguard against this as the road can be dug up occasionally and measured to ascertain that the proper thickness has been made.

The measurement of broken stone by the cubic yard or wagon leads to constant trouble in securing a full loaded wagon. There is also the question as to where a wagon load should be measured. If the specifications call for a cubic yard of broken stone delivered upon a road, the contractor must estimate how much shrinkage there will be in a load of stone due to settlement from jarring received in traveling to the work. The amount of settlement will necessarily vary with the distance of the haul and roughness of the road. This makes the actual amount of material to be furnished by the contractor somewhat indefinite; so that, unless it is possible to weigh the broken stone, the unit surface measurement is advised.

The results from a series of tests conducted by the writer to determine what is the settlement of crushed stone, and what is the consequent weight of a cubic yard of crushed stone under different conditions, will be found in the report of the Illinois Highway Commission for 1906, p. 75. These tests show that there is a variation according to the method of loading the wagon, whether the stone was dumped from a considerable distance or merely shoveled into the wagon; that, after hauling for eight or nine hundred feet, about all the settlement that would occur had taken place; that the variation in the weight of a cubic yard seemed to be from 2,400 to 2,600 lbs.; that is, a cubic yard weighed 2,400 lbs. before the settlement occurred, after the wagon had gone over the road, weighed 2,600 lbs.

There was also a large number of observations made on the settlement of limestone in carload lots, the amount of settlement corresponding with that observed in wagon loads. As a result of these tests, the Commission adopted the arbitrary value of 2,500 lbs. as the weight of a cubic yard of crushed limestone. limestone on which these tests were made had a specific gravity of about 2.70.

The per cent. of voids in a yard of crushed stone varied according to the method of loading or the height from which the stone was dropped. When dropped from 20 ft. the voids in 3-in. stone were 41.8%, varying from 48.7% when loaded with shovels. The 1½-in. size showed a variation of 42.5% to 50.5%. The ¾-in. size screenings showed a variation in voids of 39.4% to 47%, so that it is evident that there is only one way which to buy crushed stone, and that is by weight. We could, of course, assume arbitrarily so many pounds being a cubic yard, which would be near enough, perhaps, to make estimates for quantities where the cubic yard is the unit measure.

The writer has usually preferred the unit surface measurement as the basis of payment as the more satisfactory for the conditions usually encountered in country road building.

## COMPOUND ENGINE-AND-TURBINE STEAM PLANTS, AND THE RATEAU EQUALIZING STEAM RECEIVER.

That a remarkable gain can be realized in a reciprocating-engine steam power plant by working the engines non-condensing and turning their exhaust into a high-vacuum steam-turbine has been known for some years, but only in a small number of cases has the method been put into practice. The details of the method must be carefully adapted to the conditions of operation in the individual case. The most favorable case is that in which the power demand on both engine and turbine is constant or only slowly varying, and where, in addition, the turbine may be of such size as just to absorb at all times the full available power of the engine exhaust. In this case no auxiliary device is required. When the engine and turbine supply independent demands, both of which, however, are nearly constant, a by-pass to the condenser from the receiver between engine and turbine, or a relief valve enabling the receiver to exhaust to atmosphere when its pressure rises, may be required. For electric power-station service it was suggested two or three years ago that the generators of engine and turbine be run in parallel on the same network, and the engine be run under constant load (and maximum efficiency), letting the turbine take care of all load variations. This arrangement, with of course a by-pass to the condenser or an equivalent means of taking care of the excess engine exhaust, gives maximum efficiency on account of the small change in turbine efficiency with varying load. The most difficult case is where the engine runs intermittently while the turbine must run at constant output. This will occur, for example, in a rolling-mill, if the exhaust of the roll-driving engines is to be used for a turbine driving the electric lighting dynamos. The Rateau equalizing steam receiver or regenerator was invented to solve the difficulty of the varying steam supply in such service. A description of the system of applying this device may be found in Engineering News of Sept. 29, 1904, p. 282, from the pen of Mr. L. Battu. There is a large number of these regenerators in use in Europe, at present a total capacity of 120,000 HP.

Two installations of the Rateau receiver have been made in the United States, according to Mr. Battu's statements in a recent paper before the New York Railroad Club. One of these, the first in point of time, is at the South Chicago plant of the International Harvester Co., where the receiver is required to equalize the steam supplied to two 500-KW. steam-turbine direct-current sets from the exhaust of an 800-HP. reversible rolling-mill engine. The receiver contains 75 tons of water and, when its steam supply is shut off, can maintain the supply to the turbine for 5 mins. at a rate of 22,500 lbs. per hr. Its capacity is sufficient for two 500-KW. units. The second plant is at the Vandergrift works of the American Sheet & Tin Plate Co.,

also supplying steam-turbine generators from the exhaust of a rolling-mill engine. This receiver is capable of maintaining for 2 mins. a steam supply at the rate of 20,000 lbs. per hr. In both plants an automatic relief-valve maintains the pressure within the receiver between atmospheric and 3-lb. gage. The receiver and turbine plants were designed by Mr. C. H. Smoot, Chief Engineer of the Rateau Steam Refrigerating Co. The Vandergrift turbine, 500 KW., was built by the Ball & Wood Co., at Elizabeth, N. J.

## TIMBER GIRDER BRIDGES ON THE QUEENSLAND GOVERNMENT RAILWAYS, AUSTRALIA.

In common with all slightly developed countries, Australia has a plentiful supply of timber, but it has not had until quite recently any steel mill of a size to turn out structural material, and even now the new mill at Lithgow will probably not be large enough to supply the demand. On account of the relative availability of the two materials, there are many structures erected of timber which, in an older country, would be built of steel. In railway work, particularly, this utilization of timber has led to the adoption of some standard structures which are very interesting, such bridges, for instance, as are illustrated on this page.

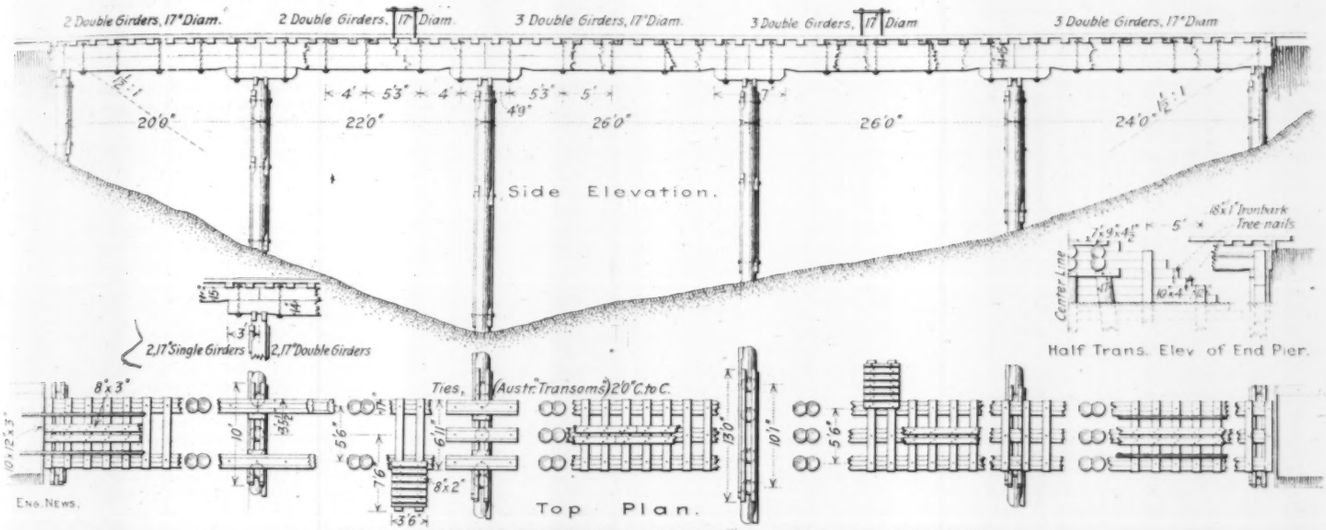


FIG. 1. STANDARD TIMBER BRIDGE ON THE QUEENSLAND RAILWAYS.

These bridges, which have recently been standardized by the Queensland Railways, are built principally of ironbark and spotted gum, both hard woods having a safe unit tensile stress of 2,240 lbs. per sq. in., a modulus of rupture of 6,000 and of elasticity of 2,500,000. The construction should be readily understood from the drawings. It consists of girders of stripped logs, in layers of one to three, according to length of span, resting on regular timber bents and cross braced with timbers which act also as ties. As far as possible logs are utilized in the construction. Fig. 1 is a typical two-log girder construction and Fig. 2 shows the two types of bents, one of driven piles and the other of planted posts. The bridges are designed for three 12-ton axle loads on a 10-ft. wheel base with a 3 ft. 6 in.-gage.

We are indebted for these drawings to Mr. W. Pagan, Chief Engineer of the Queensland Rys.

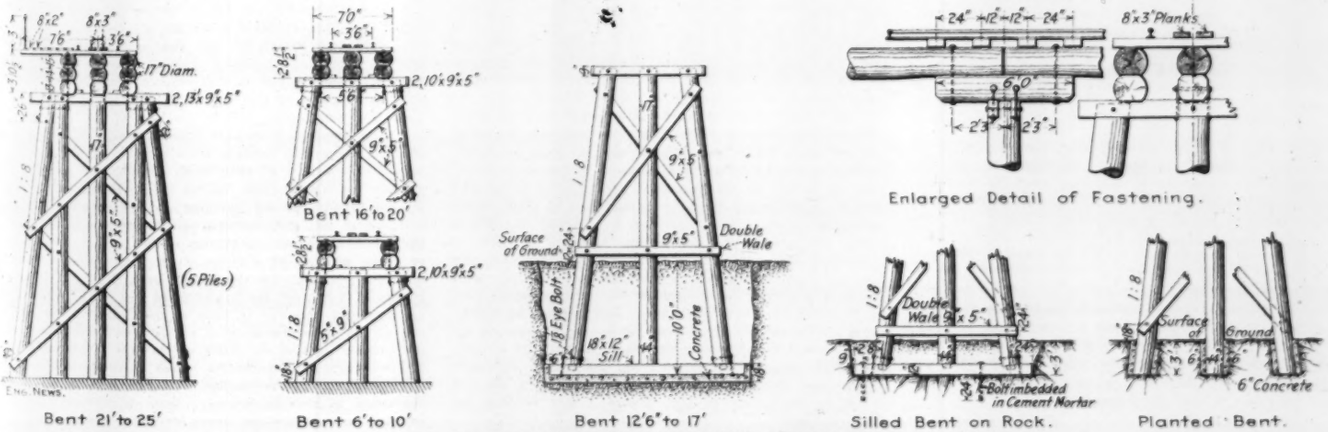


FIG. 2. DETAILS OF TIMBER BRIDGE CONSTRUCTION.

## THE PERFORMANCE OF STORAGE-BATTERY MOTOR-CARS ON THE PALATINATE RAILWAYS (GERMANY).*

By A. GIESLER.†

As the use of storage-battery or accumulator motor-cars on main lines has become more extended, it may be of interest to give an account of the results obtained during more than ten years' trial on the main lines of the Palatinate Railways. The first experiments were made in 1893, on a narrow-gage suburban line, and were extended to a standard-gage main line in 1896.

In 1900, at the end of the period of trial proper, the Palatinate Railways possessed four standard-gage and three narrow-gage accumulator motor-cars. Since then the latter have been withdrawn from service, owing to the extension of the street railway system at Ludwigshafen. On the other hand, the standard-gage stock, which had consisted of two six-wheeled and two eight-wheeled motor-cars, was increased in 1902 by the addition of two other eight-wheeled cars. It was decided not to add to the six-wheeled cars, as these had a greater weight per seat; and as they only contained 68 seats (against 114 in the eight-wheeled cars), it frequently happened that they were unable to accommodate the traffic unless trailers were taken. It was also found in operation that the 45-ton eight-wheeled cars required but little more current, when running on the level, than the six-wheeled cars, which weighed about 7 tons less. This is no doubt due to the smaller resistance of cars with trucks. An attempt was made to reduce the resistance of the larger cars still further, by using roller bearings, but without success. The eight-wheeled cars have the material additional advantage that their construction, with a central gangway (as in American cars), gives considerable space available as standing room. Experience shows that when there is a sudden rush of traffic, passengers prefer to stand during a short journey, rather than wait for the next train.

The weight per seat (870 lbs.) compares favorably (in spite of the heavy weight of the lead accumulators) with the weights usual in other types of railway cars. This is due to the good design of the motor-car. Hence there is no reason to reduce the weight of the batteries to the lowest possible limit by using very thin plates and placing them very close together, which would have an unfavorable influence on the life of the battery and make maintenance more difficult.

The batteries used for both six-wheeled and eight-wheeled cars are of the same size; their total weight is 15 tons, and their capacity when new is 250 ampere-hours. The batteries are placed below the seats in 26 wooden boxes each containing 6 cells each; thus there are 156 cells connected in series while running. Each cell has seven positive and eight negative plates $11^{13}/_{16}$ ins. square, fixed in a hard-rubber cell. The positive plates are about $^{5}/_{16}$-in. thick. The cells are connected by double lead strips, which are connected by means of binding screws provided with special protection against the action of the acid. The boxes are connected by means of cables. The total weight of the battery is made up as follows:

| | |
|---|---|
| 156 cells and acid (187.4 lbs.) | 29,233 lbs. |
| 26 wooden boxes (123.5 lbs.) | 3,210 lbs. |
| 156 lead connections (3.5 lbs.) | 551 lbs. |
| Total | 32,994 lbs. |

In order to have as many as 114 seats, the body of the car had to be 9 ft. 10 ins. wide. It was considered indispensable to have side doors so as to enable the pas-

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sengers to get in and out quickly, but the steps extended beyond the usual loading gage. A device was therefore adopted, by means of which the steps could be folded back by a hand lever at the side of the car. The steps when folded back interlock with the side doors, which if open would also project beyond the loading gage. Instructions are issued to the staff not to start the car until the steps have been folded back and the side doors consequently locked. On each side of the car, there are 10 side doors. Two of these are kept locked and are convenient for bringing in and taking out the batteries.

The accumulator boxes are 3 ft. 7$^{13}/_{16}$ ins. long, 1 ft. 7$^{7}/_{8}$ ins. wide and 1 ft. 7$^{5}/_{16}$ ins. high. They are let about 2$^{5}/_{8}$ ins. into the floor of the car and are located under the seats. There are 38 seats, and 26 have accumulator boxes below them. The others have heaters below for briquettes. The accumulator boxes are not in the middle of the car, but distributed more over the trucks. At first they were also placed in the middle of the car, but at a certain velocity the car oscillated objectionably. Provision is made inside the car for attaching tackle by means of which the boxes can easily be lifted out onto a low truck, running on rails, when any repairs are necessary. The truck is then run into the workshop.

At each end of the car there is a driver's compartment so that it is not necessary to turn the car. In each of these compartments there is a series-parallel switch of the usual pattern, a voltmeter and an ammeter, a bipolar emergency switch together with the single switches and fuses of the two main motors, as well as a brake and a signaling alarm operated by a foot lever. There is also an electric alarm bell which can be operated from the different compartments by pushes marked "emergency signal," to make the driver stop at once. The resistances of the motors are under the floor of the car. At one side of the car there is a case, which can be locked, which contains the charging switchboard and the charging plugs, the battery fuses and a switch lever which enables the batteries to be coupled up in two parallel lots of 78 cells each, so as to reduce the pressure to that suitable for charging. A simple safety device is connected with the switch lever to prevent the charging cable from being switched on when the pressure of the 156 cells coupled up in series exceeds the pressure of the charging dynamo.

The car is driven by two motors on one truck. The power is transmitted to the two axles through toothed gearing having a ratio of about 1:3. The two motors are located on one truck in order to make it easy to examine them simultaneously from a comparatively short pit. The greater wheel-load of the motor truck is in part neutralized by distributing the batteries so that the greater part of their weight comes on the other truck. The motors are designed to produce a speed of 28 mi. p. hr. when the loaded car (about 50 tons) is run on the level. By reducing the intensity of the magnetic field it is possible to increase the speed to 30 or 34 mi. p. hr., but as a rule any such reduction is avoided, as too much current would be used.

If we assume the mean pressure of discharge of each of the 156 cells to be 1.9 volts, then the total pressure available at the motors will be (in round figures) 300 volts. If the motors are in parallel, the mean load of each motor is about 65 amperes; of both together about 130 amperes. This mean load may in increased to 100 amperes if the weather is bad, if there is a head wind, if the speed is increased, if the intensity of the magnetic field is reduced, or if trailers are added. The specifications provided that the motors should have an efficiency of at least 85% at the mean load of 65 amperes, and that they should stand a load of 120 amperes for 20 minutes without injurious heating. The latter is the load if one motor becomes damaged and the other has to run the car by itself.

The car is lighted by electric lamps fed by the batteries; the usual petroleum lamps are used for train signals. The main part of the car is divided into three compartments, which communicate. There are two smaller compartments near the end, each with 21 seats, and the chief compartment in the middle with 72 seats. The empty driving compartment at the rear is used for baggage, mails, etc.

As the towns on the line are only short distances apart and there is considerable traffic between them, the conditions are specially favorable for a stopping or local service. It is also a great advantage for the motor-car service that the lines form a connected network, and are not separate and disconnected.

There are four charging stations. Their equipment is very simple. The cables coming from the power stations are led into a wooden cabin located along the siding provided for the accumulator car. The cables go to a small switchboard, equipped with lead fuses, an ammeter, a current meter and a bipolar main switch. Behind the main switch, the conductor continues in the form of two-pole cable about 26 ft. 3 ins. long, which consists of two flexible copper cables, well insulated and protected, terminating in the plug fitting into the charging contact of the car. An alarm bell circuit connects the charging station with the central power station, and a system of signals is arranged to indicate when the charging dynamos are to be started and stopped. Where required, a pit is provided for examining the motors.

As already stated, the batteries of a car are connected in parallel in two sections of 78 cells each, so as to suit the charging pressure available. The charging is, as a rule, effected by a 200 ampere current, equal to 100 amperes to each section. The pressure during charging rises from 156 to 200 volts; the mean pressure may be taken to be 175 volts. The amount of energy which can be supplied to the car in one hour therefore amounts to $(200 \times 175) \div 1{,}000 = 35$ KW.-hrs.

The simplest and most economic way of charging is to have a separate dynamo feeding the cable from the power station and disconnected from the rest of the system; it is then possible to adjust this dynamo, in a very simple way, to suit the alterations of pressure which occur when a battery is charged by a current of constant strength. Originally at some of the stations, the batteries were charged by a current having a constant pressure of 220 volts; it was then necessary to insert resistances which owing to the somewhat large and continuous loads had to be of large size, and consequently involved the loss of by no means inconsiderable quantities of energy.

All the charging stations are now equipped for direct charging by a dynamo disconnected from the rest of the system. At Ludwigshafen and at Neustadt, the charging station is supplied with current by the central electric lighting station owned by the railway. At Landau and Schifferstadt, the current is supplied by a municipal and by a private station respectively. The sections of line between two power stations, or operated from any one station, have lengths of from 7.6 to 27 miles (average 16.8 miles), with grades of from 0.6% to 0.3%.

The longest journey a car has to take without recharging is 27 miles. As measurements show that the mean current consumed amounts to 32.7 watt-hours per ton-mile, the current consumed by the car (50 tons when loaded) is about 1.6 KW.-hrs. per mile; 43.4 KW.-hrs. are therefore required for running 27 miles. If we take the mean discharging pressure to be 300 volts, it follows that the batteries of the car must have a capacity of at least $(43.4 \times 1{,}000) \div 300 = 145$ ampere-hours, in order to be able to supply the current for the trip in question.

As the capacity of a car is continually becoming reduced approximately directly as the distance run, a car with new batteries of 250 ampere-hour capacity is in the first place (stored energy, $250 \times 300 = 75$ KW.-hrs.) used for those journeys in which the minimum capacity required is say 145 ampere-hours, as in the instance given above. The car is then used on this run until the battery no longer satisfies the requirement of having a capacity of 145 ampere-hours. It is then transferred to another section where a smaller capacity is sufficient, and there used until the capacity is so much reduced that the renewal of the positive or negative plates can no longer be postponed. By such proper gradation of work, much can be done in improving the economic utilization of the battery.

Before the car is started, it is generally charged for about five minutes. A comprehensive estimate of the time required for charging may be made as follows: An hour's run at 21.7 miles per hour requires, at 2.4 KW.-hrs. per mile, 52.5 KW.-hrs. At 200 amperes and 175 volts $= 35$ kilowatts, the time this requires for charging is $52.5 \div 35 = 1\frac{1}{2}$ hours. Therefore each hour's run necessitates about $1\frac{1}{2}$ hour's time for charging. From the current consumed, 32.7 watt-hours per English ton-mile, or 1 KW.-hr. for the 50-ton cars, and from the observation that the charging current required is 2.4 KW.-hrs. per mile run, it may be deduced that the efficiency of the battery is $1 \div 1.5 = 0.66$.

It has been found advisable in certain cases (in order to avoid unnecessary journeys and to increase the range of the accumulator car system) not to run the motor cars empty, but to have them coupled to passenger trains and so hauled by steam power. Current is saved and cost of maintenance of batteries and cost of staff. Moreover, the track is not obstructed by running the empty cars. By means of this hauling system, the field of action of these motors is increased, as the cars can be run to places which would otherwise be too far from charging stations. As the motor-car can go to the rear of the train by means of its own power, switching operations are simplified. The driver of the car remains in his compartment and operates the hand brake. As a rule, the public is not admitted into the car. Fast passenger trains are not used for hauling motor-cars as the speed of revolution of the motors might become injuriously high.

The conclusion drawn from observations is that under the prevailing conditions of traffic, and under the carefully organized supervision of the batteries, the sets of positive plates have a mean life of 67,100 useful miles and the sets of negative plates 36,500 useful miles before their capacities have become so much reduced that they can no longer be depended on for the purposes of the traffic. The life of the positive plates is thus nearly twice as long as the life of the negative plates.

Besides these renewals, which had to be made at definite regular periods, it was also necessary to clean the whole battery thoroughly after each run of 12,400 to 18,600 miles. Until lately, when this took place, the separate negative plates were coated, as otherwise the average of 36,500 miles could not have been attained with the negative plates using operation, which was somewhat costly as coating required much time, was carried out at the railway. For tunately, it can now be eliminated altogether because the Berlin Accumulator Co. is able to supply an improved negative plate. Such plates are now in all the six cars, and it is already evident that without any coating operations, the plates will give as good results as the 16 older sets of negative plates. One of the new sets is still in use and has already run 43,500 miles.

As far as possible, the periodic cleaning and renewal operations for the proper maintenance of the battery, and the other examinations and repairs of the cars were carried out at the same time.

The average time during which the cars had to be withdrawn for repairs during seven years was 18%. The average for the locomotives of all the German railways in 1905 was 18%.

The cost of maintenance of the cars, motors and batteries was from 1.263 cts. per useful car-mile in 1900, to 6.566 cts. in 1903, and 3.94 cts. in 1906. The cost of maintenance was low at first, then rapidly increased in the years in which battery renewals were most frequent, and then again decreased. The mean figure for the cost of maintenance for the whole seven years is 3.9 cts. per useful car-mile. By way of comparison, it may be stated that the mean total cost of the maintenance, renewal and improvement of the locomotives of all the German railways in 1905 was 4.442 cts. per useful locomotive-mile.

After the cost of maintenance we have to consider the cost of traction. In the case of accumulator cars this is composed of the cost of the electrical energy supplied and the cost of lubricating, cleaning, lighting and heating the cars. The observations made during 1900-1906 as to the consumption of energy, measured at the charging stations, showed an average for the four years of 2.4 KW.-hrs. per useful car-mile. The cost of current varied in different years between 2.4 and 2.64 cts. per KW.-hr. The cost was not the same at the different supply stations owned by the railway and by others, and consequently the mean cost varied. Taking the mean cost to be 2.52 cts., the cost of electrical energy amounts to 6.10 cts. per useful car-mile. The cost of lubricating, lighting and heating was accurately determined during one year, and found to be 0.735 ct. per useful car-mile. Adding this to the cost of the electrical energy, we obtain a total cost of traction of 6.835 cts. per useful car-mile.

The greatest economic advantage shown by the motor-car as against the steam trains, is the saving in wages of train crews, as only one driver and one conductor are required for each motor-car. The total cost of maintenance, traction and staff will amount to about 13.5 cts. per mile.

It may be definitely asserted, on the basis of the experience of a number of years, that an accumulator motor-car service can be economically successful in cases where the lines concerned are on the level and not too long, where there are suitably located charging stations at which current is produced cheaply, and where conditions are such that proper supervision of the batteries is possible.

A specially favorable result shown by this service, which has been operated a number of years, is the fact that only very rarely did any sudden breakdown in the service occur. This shows that the accumulator cars are very reliable, and in this respect compare favorably with most kinds of gasoline and steam motor-cars. Indeed the construction of the car and of the equipment gives the greatest guarantee against sudden breakdowns. If the battery fails because some of the lead connections break, the fault is at once easily repaired by putting in a spare connecting piece, unless it is preferred to couple up the battery, as for charging, in two parallel halves, and run at half the pressure, and consequently with half the speed, to the next stopping station. If the armature or other winding of a motor fails, that motor is automatically cut out by the safety fuse, and the second motor is then used for running the car; its dimensions are such that this can be done without any difficulty. If one of the switchboards goes wrong, the switchboard in the compartment at the other end is there as reserve.

When worked for a number of years, motor-cars naturally do not escape the smaller accidents liable to occur in operating a railway service, such as derailment at switches and turntables, minor collisions during shunting operations, etc.; it was found that the accumulator motor-cars showed a good resistance when subjected to such unusual treatment. And although the normal path in life of a motor-car does not exactly include running over wagons and through walls, yet it appears of importance to note that the records of these accidents show that the accumulator motor-car is a vehicle which can stand the rough treatment which cannot always be avoided in operating a railway, better than would have been expected from the combination of vehicle and batteries.

Finally, it may be stated that the chief conclusion to

be ...wn from the experience of the Palatinate Rail... extending over a number of years, is that an ac... motor-car service can be economically, suc... if the battery is well and carefully maintained, ... the current can be generated at a cheap rate. In ... have a motor-car system which is reliable to a ... degree. These advantages probably outweigh the ... antages inherent to accumulator cars; the allow... that has to be made, when drawing up the time-... for time of charging; the very careful supervision ...; and the fact that the possibility of using them ... quently limited by the size of the battery and the ... of charging stations.

... Gayer, the Assistant Manager of the Palatinate ...ays, has the merit of having been the first to pro... the application of accumulator motor-cars to stan...-gage lines, and of having subsequently developed ... system.

## CONTROLLING THE OUTPUT OF THE AIR COMPRESSOR.

By FRANK RICHARDS,* M. Am. Soc. M. E.

To one who has never given the matter any thought, and who has been so situated that some knowledge in the special direction has not been forced upon him, an air compressor may still seem to be a simple apparatus and its working conditions easy to be satisfied. It is only another pump, it may be thought, and of course easier to work than a pump for water on account both of the lightness and the elasticity of the material handled.

It happens, however, that each special property of atmospheric air adds its own special difficulty to the operation of compression, and the problem of economical air compression, as a whole, is one of the most complicated and one of the farthest from complete and satisfactory solution still before the practical engineer.

It would be wasting time and space here to go into a discussion of the specific difficulties inseparable from air compression; it will be sufficient to merely mention one or two of them. The elasticity of the air, in contrast to the non-elasticity of water, is perhaps the first thing to make trouble. With a water pump little attention need be paid to the clearance, or the unswept space at the end of the stroke. All this space is filled with solid water, and there is practically no loss in efficiency from it. But in air compression, whatever air fills the clearance space at the end of the compression stroke cannot be expelled or delivered, and might better not have been operated upon at all. Being at the high pressure of delivery it must reexpand upon the return stroke to atmospheric pressure before other air can begin to enter for the next stroke, and the space occupied by this reexpanded air must all be deducted from the theoretical stroke displacement, often amounting to a considerable percentage reduction of the volumetric efficiency.

The heating of the air during the compression is another source of loss and trouble. At the end of the stroke the volume of air delivered is, in consequence of the heat, greater than will be available for use after the air has cooled again; but in the compression operation the power required has been proportionately higher all through on account of the augmented temperature. The heat also makes trouble with the lubrication, and in continuous running becomes a source of actual danger, so that stage-compression, water jacketing, intercooling and other devices have to be employed, with results never more than partially satisfactory.

The moisture always present in air also becomes a serious nuisance when the air is compressed, and in many of the devices in which compressed air is used it causes much delay and inconvenience, so that one function of the compressor and its appurtenances is to as far as possible eliminate the moisture.

In the water pump the resistance to be overcome in the act of pumping is practically constant for the entire stroke. In compressing air there is practically no air resistance to be overcome at the very beginning of the stroke, but the pressure rises as the piston advances and most of the power is required for the final compression, and then the expulsion of the air at its maximum pressure. In the steam-driven machine (the steam of course for economy being used expansively) the minimum driving pressure is at the end of the stroke when the air resistance is the greatest, and at the beginning of the stroke the high steam pressure finds little in the air cylinder to oppose it. This anomalous arrangement of decreasing operating force and increasing resistance to be overcome must be recognized and provided for in the machine itself, and at best the result is a constantly reversing balance of stresses.

These things are all sufficiently familiar to all who have to do with air compression, and they are only alluded to here by way of introducing another exacting requirement which practically all compressors encounter. This, also, is not a new trouble, but it seems to be, up to the present writing, the one which has most signally failed to elicit adequate or at all satisfactory corrective devices. Here again the contrast is sharp between the water pump and the air compressor. The pump not only has a constant resistance for the stroke, but its output can be taken and stored in tank or reservoir as delivered, so that a pump usually can run all day long at constant speed and with uniform delivery.

### COMPRESSED AIR SERVICE ALWAYS INTERMITTENT.

Compressed air has the double disadvantage that it is used intermittently and that it cannot be stored in large quantity. Few air-operated devices run continuously or with a constant and uniform consumption of air, and where, as is usual, many rock drills, pneumatic tools, hoists or other apparatus are to be driven, sometimes all of them may be drawing air at once, and sometimes few or none of them. At the same time comparatively little compressed air can be held in storage, and whatever the storage capacity it is generally impossible to maintain a uniformly effective pressure without wide fluctuations in the rate of compression. The total capacity of the usual air receiver installed with a standard compressor is only about equal to one minute's output of the compressor.

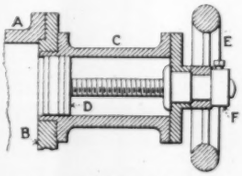


Fig. 1. Partial Section of Head of Air Compressor - Cylinder, showing Clearance Variation Chamber Attached.

As the air consumption is never constant there can be only one way to maintain an always sufficient supply at constant pressure, and that is to have a compressor of capacity equal to the maximum demand and then to keep a safety-valve blowing away air most of the time, thus wasting large volumes of air and the power expended in compressing it, besides the nuisance of the air discharge in itself. It may be assumed that in ordinary compressed-air practice one-half or three-quarters of the air compressed, and of the power used to compress it, might be blown away by this scheme.

It is entirely impossible to control the output by varying the speed of the compressor, as the range of permissible and controllable speeds is generally entirely inadequate, and frequent stopping and starting of the machine is not to be thought of.

Constant speed is the ideal for the air compressor, even when steam-driven, and with the rapidly increasing number of compressors which are driven by electric motor or Pelton wheel the constant speed is insistent, and other devices are demanded for controlling the volume of air compressed and delivered.

No one can say that the arrangements proposed for this purpose, some of them extensively used for want of anything better, are at all satisfactory. We can only allude to one or two of the devices in use, and it must be left to the reader to see for himself the objectionable features of each and the failure of all to more than partially comply with the requirements. What is wanted, of course, is an automatic and at all times perfect adjustment of the output to the varying rate of consumption, with, as an accompaniment, a corresponding saving of the power employed when the compressor is working below its full capacity.

One device, perhaps as extensively used as any, operates in the following manner: when the air pressure rises above a predetermined point a discharge valve of the compressor remains open and then the compressed air plays back and forth in the cylinder instead of having its volume increased by additional compression. The compressor in this case is either compressing air or it is not, and while air consumption goes on at all, though at a much reduced rate, there must be a frequent throwing on or throwing off of the load, and at no time is the rate of compression adjusted to the rate of consumption.

Another system of regulation automatically opens the inlet valves when a certain pressure on the receiver is exceeded, and while they remain open free air is free to rush in and out of the cylinder without being compressed. Here, too, the compressor is either compressing or it is not, and there is no graduated adjustment of the load to the requirement. In this case, however, either end of the cylinder may be thrown out of work independently of the other, and in the case of the duplex machine there are thus four ends of two cylinders which may be thrown out of action one after the other, with a little difference in delivery pressure between each two in succession until all compression ceases, when of course there must begin a step-by-step resumption of compression, and so on continuously. There is extant a published description of a duplex tandem-compound belt-driven compressor, in which there are eight inlet valves to be manipulated, and these are thrown in or out of service in pairs, a low-pressure one on one side and an alternate high-pressure one on the other side, four successive steps of this character leaving the compressor "marking time" and the air blowing in and out of each end of each cylinder.

There are other devices for the purpose, which it is not necessary here to speak of, and some still in the experimental stage which have not yet come to the knowledge of the public; but not one of the devices satisfies the case, and neither the users nor the makers are satisfied with them.

### CLAIMING THE PROTECTION OF PUBLICITY.

That the thing desired is perfectly possible of accomplishment no one will doubt, and to strengthen and confirm conviction I here bring to the notice of the public my own recently invented unloading device. My convictions are strong as to its entire practicability and value, and intending to secure it if possible by patent, I here take the perhaps unusual precaution of securing the preliminary protection of publicity.

The device is extremely simple and will be easily understood from Fig. 1. Here A is the end of an air-compressor cylinder, B being a portion of the cylinder head. To the cylinder head is fitted an auxiliary clearance chamber or cylinder C, the piston D of which is here represented as flush with the interior face of the cylinder head B. With the piston D in this position, the air-compressing cylinder has only its normal clearance, and we may assume that compression is going on in the usual way and with the maximum output of compressed air, the entire cylinder full of air being compressed at each stroke and all except the small quantity which fills the unavoidable clearance space being expelled into the discharge pipe.

In this working of the compressor at its full capacity the unexpelled compressed air remaining in the clearance space reexpands as the piston recedes, and when it has gone, say, an inch or so the pressure will have fallen to that of the surrounding atmosphere, and then the free air will rush in and follow the piston, filling the cylinder for the next compression stroke.

By turning the hand wheel E the piston D may be withdrawn some distance from the po-

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sition shown, where it is flush with the inner surface of the cylinder head B. This withdrawing of the piston D thus makes a considerable addition to the normal clearance of the compressing cylinder A, and when the next compression stroke occurs this additional space will be filled with compressed air which otherwise would have been expelled into the discharge pipe. Upon the return stroke all the air in this clearance space, in addition to that which fills the regular clearance, will reexpand, with the result that the pressure will not fall to atmosphere until the piston has traveled a greater portion of its return stroke than before. Say that the pressure in the cylinder only comes down to that of the atmosphere when the piston has made one-half of its return stroke; then only one-half of the cylinder will be refilled with free air and only one-half of the cylinder full of air will be compressed and delivered. If the piston D be withdrawn to double the distance just assumed, then the reexpansion of the compressed air will continue throughout the entire return stroke, atmospheric pressure will not be reached until the end of the stroke, no additional free air will enter the cylinder, and none will be compressed and delivered.

The piston in the cylinder continuing to reciprocate at regular speed, the air-compressing function will be entirely suspended and will not be resumed until the piston D is moved in the opposite direction and the auxiliary clearance space is reduced or entirely eliminated, the latter occurring when the stop collar F comes against the end of the threaded sleeve.

It is worth while to note how satisfactorily the desired result of throwing the compressor out of action without changing its speed is here accomplished. The air in the auxiliary clearance plays in and out with no perceptible friction, the power expended in compressing the air into this space is given back by its reexpansion upon the return stroke, and there is also no raising of the temperature of the air, as however much the temperature may rise upon the compression stroke it must correspondingly fall when the reexpansion occurs.

To make the movement of piston D automatic, so that the air compression may be correctly adjusted to the air consumption, is not difficult, and may be accomplished in various ways. Fig. 2 is merely a sketch of one arrangement, with no attempt to show details. Here, again, we have the compressor cylinder A, the body of the cylinder and the heads being water-jacketed in the usual way, and we have also a clearance cylinder for each end of the compressor cylinder, these clearance cylinders in this case being placed upon flat faces which are cast on the side of the compression cylinder. When the pistons in these clearance cylinders are at the bottom of their cylinders the compressor will operate as if these clearance cylinders were wholly absent. Even the ports are filled by the lugs L L and the clearance remaining will be negligible.

In place of the hand wheel in Fig. 1 we have here the worm wheels, W W, the worms which actuate them being upon the same shaft, so that the pistons must always move in or out together. This worm shaft is connected by suitable gearing to a reversible electric motor, which is actuated in either direction by switches that are operated alternately accordingly as the pressure in the air receiver rises or falls. The speed reduction must be much greater than is here indicated, as the movements of the pistons should be quite slow, so that only a small motor would be required.

The readiest and most natural objection, and also perhaps the most absurd, which can be offered to this device is as to the cost involved. The wise engineer should be the last man to expect to get something for nothing. The advantage promised in this case is sufficiently obvious, and the cost of the advantage thus secured makes it an engineering bargain such as is seldom offered.

From the catalog of one of the leading builders of air compressors, I recently drew some particulars concerning two compressors of different classes and of approximately the same capacity, the one a "simple" machine and the other with all the refinements of economy and up-to-date efficiency. The rated horsepowers of the two showed a saving of 11% in the high class machine, but it weighed 63% more, and the price of it was 45% higher; and yet the higher priced machine is always chosen by the big, winning contractors. The automatic controller might add 5% to the total cost of the machine, and there are many cases where it could save 50% in power and make a wider possible field for the employment of the machine by making it reliable and independent.

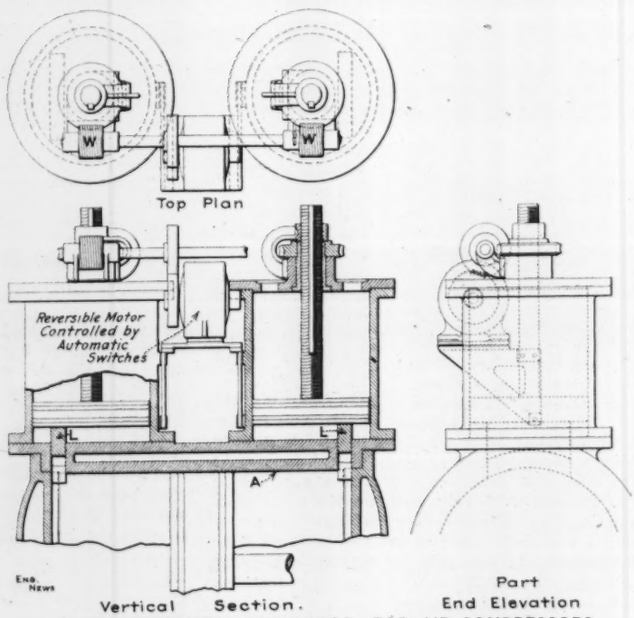


FIG. 2. AUTOMATIC REGULATOR FOR AIR COMPRESSORS, OPERATING BY VARYING CLEARANCE SPACE.

In recapitulation the reader is reminded that the chief purpose of this article is to call attention to the proposed use of a *controllably variable clearance space* in connection with the cylinder of an air compressor, the space when fully opened being sufficient to receive the entire stroke content of the cylinder, allowing it to be compressed into this space and then to reexpand into the compressing cylinder, none of it being delivered as compressed air into the discharge pipe, and then the adjustment, automatic or otherwise, of this clearance space so that only a portion of the air compressed per stroke will be delivered according to the amount of compressed air required.

Fig. 2 is to be regarded as only a crude sketch of one possible mode of applying this device, others being in process of development. Of course an air motor may be employed instead of the electric motor, the air pressure being necessarily always present, and the compressor then would be, for control, entirely independent of anything outside itself. The sketch is made to scale sufficiently to indicate the relative size of the clearance cylinders, the ratio to that of the compressing cylinder being one-fifth, which is presumably as large as would ever be required. The size of ports and other parts would be soon determined by experiment. It may be suggested that the air to travel the port would have the time of the entire stroke to do it in, instead of a quarter of the stroke or less for passage through the discharge port when full compression was in progress.

## SAMUEL DE VERE BURR.

It is with great regret that we record in this place the sudden death of Mr. S. D. V. Burr, who has been for more than a quarter of a century a prominent figure in American engineering journalism. Mr. Burr had been in usual good health up to a week previous to his death. An attack of appendicitis which began on Sunday, Oct. 25, resulted in his death, which took place at his residence in Plainfield, N. J., on Wednesday evening, Oct. 28.

Mr. Burr was born in New York City Jan. 23, 1855. While still a youth his parents removed to Plainfield and he entered the High School there graduating in the class of 1870. He then went to Rutgers College where he graduated as a civil engineer and from which he received later the honorary degrees of Bachelor of Arts and Master of Arts.

Mr. Burr did his first work as a technical journalist during the years from 1880 to 1883 on the staff of Engineering News, shortly after the publishing offices of this journal were removed from Chicago to New York City. His next connection was with the "Scientific American" where he remained for six years. He then joined the staff of the "Iron Age" and was an associate editor there for 16 years. In recent years he has been connected with "The Metal Industry" and held this position at the time of his death.

Besides his regular editorial work he assisted his father, Samuel J. Burr, A. M., in the preparation of two volumes on the Centennial Exhibition and was the author of books on Bicycle Repairing and Tunneling under the Hudson. He prepared for the Chamber of Commerce of New York City a monograph on the Rapid Transit System of New York and other great cities.

Mr. Burr is survived by a widow, a son and a daughter. Funeral services were held from his residence in Plainfield on Saturday afternoon, Oct. 31.

REMARKABLE STEAM ECONOMY was shown by a German self-contained engine-and-boiler set tested recently by Prof. M. Gutermuth of Darmstadt, Germany. Superheated steam and a compound engine having both cylinders seated in the smokebox and therefore jacketed by the hot fluegases, are the special features of the plant tested. Three tests, at 130 HP., 103 HP., and 78 HP., respectively, gave the following results: Steam consumption, 9.06 lbs., 8.86 lbs., and 9.56 lbs. per HP.-hr.; coal consumption (with coal of 13,900 h. u. per lb.), 1.11 lbs., 1.06 lbs., and 1.13 lbs per HP.hr. The superheat at entry into the high-pressure cylinder averaged 236° F., and at entry into the low-pressure cylinder (after the reheater), 200° F. The total efficiency of boiler and superheaters was found to be 77%, 78% and 78%, respectively, while the mechanical efficiency of the engine varied from 93% to 95%. The duration of the tests was 7 hrs. for each of the first two and 4 hrs. for the third test. It should be noted that the brake was attached to a countershaft driven by belt from the engine flywheel, and to obtain the engine brake power the results were increased by 4% to make allowance for the belt loss and the bearing friction of the countershaft.

The plant which gave these results was built by H. Wolf, of Magdeburg. It has an internally-fired boiler (230 sq. ft. heating surface and 7.3 sq. ft. grate surface) and a tandem-compound engine seated on top of the boiler. Forward of the boiler is a long smokebox in which are two coils of superheating tubes, a front and a rear one. The front set takes steam from the boiler and feeds the high-pressure cylinder, whose exhaust goes to the rear superheater section and then to the low-pressure cylinder. The low-pressure exhaust goes through a feedwater heater before passing to the condenser. The smokebox extends upward above the top of the boiler shell and there encloses the engine cylinders. These are 7.9 ins. and 15 ins. in diameter by 15.8 ins. stroke, and are fitted with piston slide valves. They are set tandem, with the low-pressure cylinder at the rear. The crankshaft is near the front; it carries two overhung belt flywheels. The tests are reported in the "Zeitschrift des Vereines deutscher Ingenieure" of Oct. 3, 1908.

## THE WALNUT LANE BRIDGE COMPLETED.

Partly because of the prominence due to the largest concrete arch in the world, but largely on account of the artistic merit of the design and the careful execution of the construction, the Walnut Lane Bridge at Philadelphia has received a wide publicity. Several times in the past we have published accounts of the various details of the work, and now, on the occasion of the opening of the bridge, at least to foot travel, we are glad to present a view of a portion of the completed structure. Although the heavy foliage and the absence of a comparable scale prevents an appreciation of the size of the bridge, the view does show in an admirable manner how well the masonry arch, gracefully designed and simply ornamented, fits in to the wooded landscape of Fairmount Park.

For the benefit of those who have not seen the previous articles (Eng. News, Jan. 31, 1907, p. 117; Aug. 15, 1907, p. 168) it will be sufficient to state that the Walnut Lane Bridge, carrying a street of the same name over Wissahickon Creek in the outskirts of Philadelphia, is a non-reinforced concrete structure, consisting of one main arch, 233 ft. span and 70 ft. 3 in. rise, approached on one end by two and on the other by three 53-ft. arches. The roadway is 40 ft., with two 10-ft. sidewalks and 585 ft. long. Although the arch rings are of plain concrete, steel floor beams are used in places and also minor reinforcement to guard against internal stresses. The face of the concrete has been treated by the well-known Quimby method of scrubbing until the selected aggregate appears on the surface.

Work on the bridge was started in the autumn of 1906 and has just been completed. The bridge was designed under the direction of Mr. George S. Webster, M. Am. Soc. C. E., Chief Engineer of the Bureau of Surveys of Philadelphia, and Mr. Henry H. Quimby, M. Am. Soc. C. E., Assistant Engineer (Bridges). The contractors are Messrs. Reilly & Riddle, and their engineer is Mr. Moriz Bernstein.

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**THE TEST OF A HIGH SPEED ENGINE of which a report was published in the Journal of the American Society of Mechanical Engineers for October shows a noteworthy economy and mechanical efficiency in consideration of the condition and length of service of the engine. The engine tested was a 7-in. × 7-in. American Blower Co. engine used for driving a fan and had been run almost continuously day and night for 10,000 hours. The cylinder had been badly scored and the mean diameter increased to 7.082 ins. The piston had been worn small, showing a decrease of 0.013 in. in mean diameter, and the piston rings had been broken. Before making the test, the valve was set for equal cards and new piston rings put in. At full load and 430 r. p. m. the water rate was 41 lbs. per I. HP.-hr. The indicated friction horsepower was 1.18 or 4% of the I. HP. at full load. These results compare very favorably with those obtained with new engines of the same size and type.**

## MODERN WELDED PIPE FOR WATER AND GAS.*

By F. N. SPELLER.†

Progress in manufacture is best made by cordial interchange of experience between consumer and producer. A clear discussion of the facts and conditions of service—not hearsay—will soon develop the weak points of an article which the truly progressive manufacturer will then endeavor to overcome to the advantage of all concerned. It often develops that a new material requires a variation in the method of handling to obtain the best results; here the manufacturer with his experience can help the consumer in his difficulty.

MATERIAL FOR SERVICE LINES.—At the time welded pipe was first made, puddled iron was the only material available, and for years after steel became known it was not considered for this purpose. In the development of metallurgy of steel it was found that a soft iron practically free from carbon and with a much lower percentage of foreign impurities could be made by other process than the old method of puddling. This metal was first tried about 1886 in the manufacture of pipe, difficulties were naturally encountered at first but have been gradually overcome as experience has accumulated. Although classed under the general head of "steel" this form of refined iron cannot be hardened by quenching from a red heat, and is easier to weld than puddled iron. Now we have a metal which is especially adapted to meet the modern demands in quality, quantity and low cost.

These requirements are obtained in what we call "pipe steel" by placing the responsibility of the output in the hands of a few highly skilled operators, by running the rolling mills and welding departments in close touch with the steel works, and by keeping the plant exclusively engaged in the manufacture of this steel day after day. This method of operation is essential to the best results in the mill, and at the same time the uniformity of welding quality so obtained ensures a high degree of uniformity in other respects, for passing through the welding furnace is an ordeal that effectually reveals irregularities and unsound metal.

At present the demand for welded pipe is about one and a half million tons per year—nearly as great as the demand for structural steel. About 80% of this demand is for steel pipe. In some cases where strength and ductility are important, steel is insisted upon, but for the majority of uses where the metal is up to standard, either can be used. The steel has, however, now-a-days, a general advantage over the iron in being more uniform in quality and, considering everything, experience has shown it to be the standard material for welded pipe of the future. Early experience in the use of steel for this purpose taught that certain special treatment was necessary in order to obtain the best welding quality and to enable it to stand the temperature required without undue crystallization. A certain amount of steel pipe doubtless got out in those days which would to-day be scrapped by the mill inspectors and charged up to the department from whence it came. The fact that manufacturers of iron bedsteads and electric conduits ask for this soft steel pipe, and bend so much of it cold, into all manner of shapes without practically any trouble is satisfactory evidence to us that this is the most reliable material for the purpose. Steel pipe has been adopted lately by the National Fire Protection Association as standard for sprinkler lines, and by the American Railway Signal Association for signal pipes. Vibratory tests on steel and iron signal pipe given below show the relative endurance of these materials under such stresses.

TABLE I.—GENERAL PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION OF WROUGHT-IRON AND STEEL PIPE.

| Chemical analysis. | Steel. | Wrought iron. |
|---|---|---|
| Silicon | .01 | .... |
| Sulphur | .050 | .030 |
| Phosphorus | .100 | .170 |
| Manganese | .30 | trace |
| Carbon | .07 | trace (irregular) |
| Oxides | .10 | 1.20-2% |
| Physical properties. | | *(Pulled longitudinally.) |
| Tensile strength | 58,000 lbs./sq. in. | 46,000 lbs./sq. in. |
| Elastic limit | 34,000 lbs./sq. in. | 28,000 lbs./sq. in. |
| Elongation | 22% in 8 ins. | 12% in 8 ins. |
| Reduction in area | 55% | 25% |

*These figures for iron would be considerably less if tests were made transverse to direction of rolling; the steel is practically of the same strength in all directions.

TABLE II.—TEST MADE ON 1-IN. PIPE ON THE OLSEN STAYBOLT MACHINE—DEFLECTION 5/32-IN. IN 8½ INS.

| | Average results. Load to deflect 5/32-in. | No. of revolutions. Steel. | Iron. |
|---|---|---|---|
| Series 1 (6 pieces of each) | 772 lbs. | 16,178 | 6,940 |
| Series 2 (10 pieces of each) | | 13,555 | 8,764 |

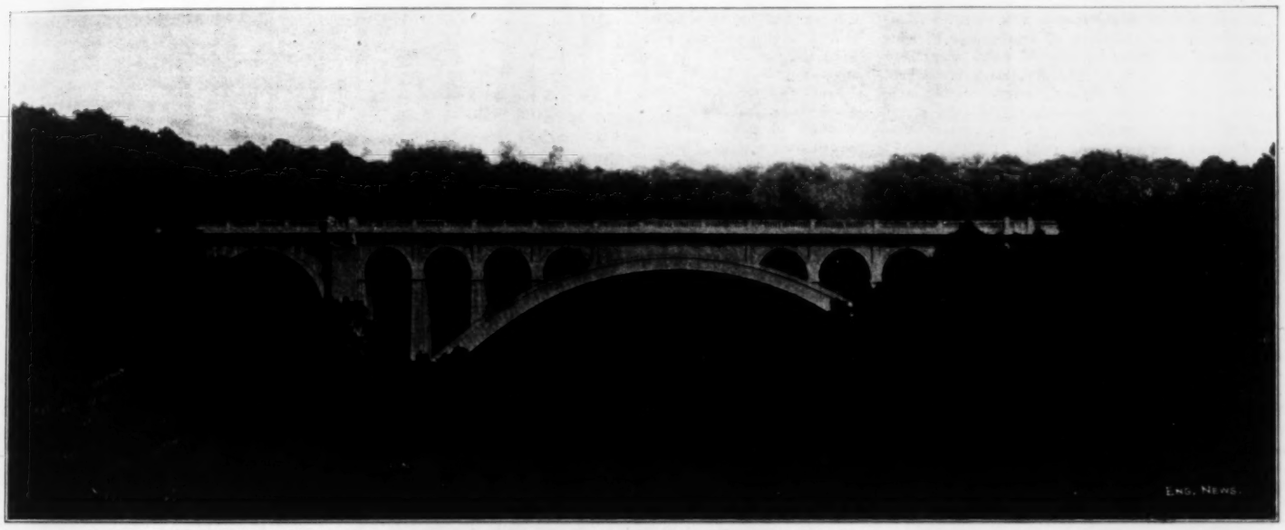
The introduction of a change in material in the manufacture of an article having such a widespread use as pipe is naturally accompanied by a certain amount of difficulty and prejudice on the part of the consumer, and opposition from those especially interested in resisting the change. The objections which have been raised to steel pipe will be briefly reviewed under the following heads:

THREADING.—The greater toughness of the steel caused some difficulty in the trade before the dies were provided with sufficient rake and relief so as to cut more readily. In the days when wrought iron predominated, a die without rake or relief would make a reasonably good thread on iron but if used on steel would work hard and probably produce a rough thread resulting in a leaky joint. Considerable economy results from attention to dies, both in time and material, as well as in saving of gas through leakage. The threads should be clean cut so that the metal to metal joint will be gas tight when screwed up, without the aid of some "dope." It is easier to make such a joint on steel pipe with proper dies on account of the homogeneity of the metal.

DURABILITY.—As to the general impression which prevailed a few years ago that steel was fundamentally more subject to corrosion than wrought iron it will be worth while for any one who holds to this opinion or has doubts on the subjects to carefully examine the basis of his conclusions, or the reports by which he has been influenced. Professor Howe, in a paper before the American Society for Testing Materials last June, sums up his experience and gives results of tests made in his laboratory and in the field, extending back to 1897. He concludes from his own test and all the information which he has been able to procure, and after a thorough study of many comparative tests by others, that there is no important difference in the rate of corrosion between iron and steel used in the manufacture of pipe, but he shows by a test on steel skelp made eleven years ago, in comparison with that made in 1906, that a decided improvement has been made in the uniformity and freedom from pitting in modern steel pipe. This has been the result

*Presented at the annual meeting of the American Gas Institute, Oct. 22, 1908.

†Metallurgical Engineer, National Tube Co., Pittsburg, Pa.




THE LARGEST CONCRETE ARCH IN THE WORLD.
Walnut Lane Arch Across the Wissahickon, Philadelphia, Pa. Main Span 233 ft.

of increased experience and much experimental work, by the leaders in the development of this steel. The influences which tend to make it more durable have been the subject of investigation for some time and finally resulted in a number of improvements, including a process of working the metal at a soft heat which gave such promising results as to warrant its adoption in regular practice two years ago. Prof. Howe's test indicate that pipe steel is now equal and probably superior to wrought iron, being less liable to local corrosion or pitting. This conclusion conforms with that of T. N. Thomson as a result of personal service tests reported in a paper before the American Society of Heating and Ventilating Engineers, January, 1908, and with our own special tests and numerous service tests, accidental and intentional, which we have investigated as they have come to our attention in the regular course of business.

[In our issue of Jan. 30, 1908 (p. 132) in discussing Mr. T. N. Thomson's paper we showed that the number of samples examined was too small to allow general conclusions to be drawn and that he had not adequately guarded against electrolysis.—Ed.]

PITTING OF PIPE.—It is now generally believed that corrosion is primarily a solution of iron in water. In case oxygen is not present the water soon becomes saturated with iron and corrosion stops with no visible serious results. However, if oxygen is present, the dissolved ferrous iron is oxidized to the ferric or insoluble state, and is precipitated as rust on the metal, allowing more iron to dissolve; thus the process is made continuous. The oxygen seems to have a further important effect, as pointed out by Dr. W. H. Walker in accelerating corrosion by combining with the hydrogen released when iron goes into solution, thereby depolarizing the cathode. Thus, it will be seen that corrosion is a simple electro-chemical phenomena* involving an interchange of electricity between two elements between which there is a certain difference in potential, and that this action is kept up through the agency of oxygen, moreover, other conditions being equal, it has been shown that the extent of corrosion is proportional to the available oxygen. Pitting or localized corrosion occurs when the difference of potential between two places on the surface of the iron is maintained in the same direction for a considerable time. This may be caused by variations in composition in the metal or accidental irregularities on the surface of the iron due to adhering foreign material such as mill scale, rust, carbon, etc. The latter are far more electro-negative to iron than the ordinary variations in composition of the metal, and usually determine the location of the pit.

It is the duty of the manufacturer to make a metal which will offer as much resistance as possible to corrosion, but where conditions are favorable the iron will dissolveand return to theform from whence it came, unless these forces are resisted by adequate protection from moisture and air. A paper might better be devoted to the subject of protection. While experience seems to indicate that no universal protective measure can be relied upon, a special study of local conditions will usually suggest the best means of protection. To secure long life in a pipe line, conditions must be favorable or be made so. It is along these lines by a study of means of protecting iron from air and moisture that future progress lies, important experiments to this end under atmospheric conditions are already under way by the Paint Manufacturers' Association in cooperation with committees of the American Association of Testing Materials. It would be well if similar tests on the protection of buried pipe lines were carried out.

Those especially interested in the manufacture of wrought iron have never proved by comparative tests that the claims that they make are borne out in service. They rely on a popular opinion which direct evidence usually contradicts and argue that as wrought iron carries 1½ to 2% of cinder interlaminated with the iron, corrosion is thereby retarded. This would be reasonable if the cinder were evenly distributed in layers, but a microscopic section of wrought iron will show that the cinder lies in slightly flattened strings, and is so irregularly distributed that loop holes entirely free from cinder are not hard to find. Moreover, it can be demonstrated that the cinder is more strongly electro-negative to iron than any other impurity present and tends to increase corrosion by the local electric currents thus set up.

[In the discussion on this paper at the meeting of the American Gas Institute, Mr. Speller said that the presence of the slag might possibly be more beneficial in puddled iron plate as there the material has been cross rolled tending to force the slag into thin scales rather than into mere strings as in skelp. Mr. Speller also said that he believed that welded steel boiler tubes would give far less trouble from corrosion than the seamless kind. If a comparison was made between seamless steel tubes and welded wrought iron, it probably would be favorable to the iron, but if the comparison trials were with modern welded steel and welded iron the result would be favorable to the steel.—Ed.]

We have taken considerable time and trouble to investigate every case of failure by corrosion which has come to our attention in the last few years and have found that wherever iron and steel pipe had been together under the same conditions, while there was generally little to choose between the two, the steel frequently showed decidedly less depth of pitting.

In an investigation of piping on the Isthmian Canal work last spring, in company with the various division engineers, we examined 160 cases where pipe had corroded in service. Out of these a dozen were found where steel and iron had been in use together in the same line and not one of these showed any decided advantage in favor of the wrought iron. Of the others, where no comparison was possible, the life of the pipe appeared to vary from twenty years (still good) to one year (completely eaten through) according to conditions. The longest-lived samples included both steel and iron, while the worst case was a ¾-in. galvanized wrought-iron water-service system of American manufacture.

It is impossible in the limits of this space to go into details on many such cases, but some instances which came to my attention recently while investigating conditions in the California oil fields, illustrate the character of this evidence. A 3-in. string of tubing in a water well at the Oregon-Midway Oil Co. property was used for six years without perceptible damage. Instead of continuing to pump direct, it was decided to use the air lift system and another string of the same tubing was installed, which lasted just three months, when nearly every length was found to be perforated at the threads, except the bottom piece, which was entirely eaten through. This piece was pointed out to me as being the worst example of the trouble, and on examination proved to be wrought iron, while the rest of the line was steel.

Near Lompoc, Cal., some steel casing had been pitted through in places and removed from a well. The corrosion was quite local, and usually affected only one side of the casing. The couplings which were of forged wrought iron, were found just as badly pitted, and in some cases completely eaten through, although much thicker than the casing proper.

One more instance may be useful as illustrating many cases of the same kind which have come to our notice. A drying kiln in a large cooperage plant was equipped two years ago with 1-in. and 1½-in. steam-heating coils. Considerable condensation took place and a few weeks ago the system gave way in a number of places due to rapid corrosion. Four sample pieces were forwarded to us with the request that in future wrought iron be furnished. Three of these pieces which were perforated, proved to be wrought iron, and the other, which was corroded about half way through, was found to be steel.

My first experiments on this subject were made over four years ago in the laboratory when we suspended pieces of standard pipe materials in hot aerated water. No important difference could be noticed under these conditions, but we were led by this and other considerations to distrust the popular opinion as to the durability of iron, the error of which has been since further demonstrated in a more practical manner by abundant evidence like the above.

As to the basis of the general opinion on this question, to which I have referred, at present we can only surmise. Those holding it nowadays for the most part do not distinguish between pipe steel and other grades of steel which do not require such careful attention in manufacture, and probably do not take into account the fact that conditions governing corrosion are much more active to-day than twenty years ago, or that whereas steel pipe has been passing through a period of evolution, and together with other branches of the industry is becoming better understood year by year, the tendency is toward deterioration in wrought iron on account of the passing of the old-time puddler and the practice of using steel scrap, often of unsuitable quality, for the sake of economy. Furthermore the properties which distinguish these materials are not generally understood and in many cases their identity has been mistaken.

Many of the cases of comparative corrosion investigated by us have been on steel and iron pipe made before any special attention was given to the quality of the steel in resisting corrosion and this evidence certainly does not lead to any important conclusions one way or the other. Surely then it is reasonable to expect that the work already done toward improving pipe steel will produce still more satisfactory results in the future.

*[A more extended discussion of the electro-chemical and other theories of the corrosion of iron will be found in Engineering News, Sept. 26, 1907.—Ed.]

## THE CLOSURE OF THE CHARLES RIVER D

By EDWARD C. SHERMAN,* Assoc. M. Am. S

One of the most interesting events in t struction of the Charles River Dam at and Cambridge, Mass., occurred on Octob 1908, when the gates of the "shut-off" da dropped and the tidal flow in the river stopped.

A general description of the dam was pu in Engineering News, Oct. 6, 1904. Th followed in Engineering News, Jan. 12, 19 another article, in which are described th and sluices and the shut-off dam for ar the tidal flow. Both these articles were by Mr. J. Albert Holmes. A description lock-gates, by the author of this article, ap in Engineering News, July 9, 1908.

The capacity of the Charles River Basi tween mean low and high water levels, i 000,000 cu. ft., the normal range being abo feet. With this enormous quantity of water bing and flowing twice daily, it was impossi deposit the earth to form the dam and ha remain in place, so that a shut-off dam, which could be closed all at one time, had to be constructed. The Charles River being a navigable stream it was not permissible to proceed with

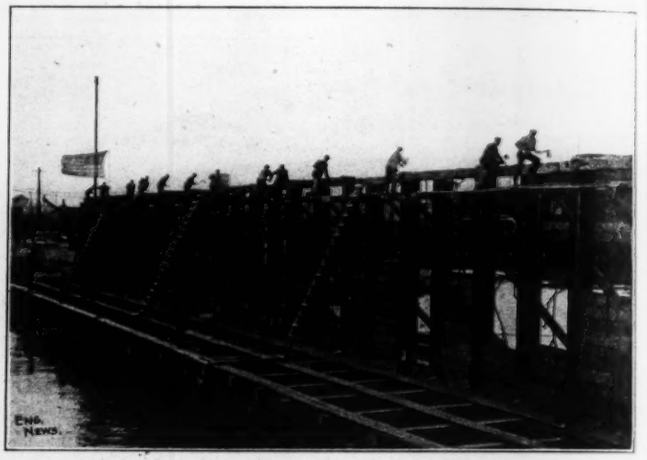



FIG. 2. VIEW TAKEN AT MOMENT OF CUTTING THE SUPPORTING ROPES.

this work until the lock was completed. As soon as river traffic was transferred from the old channel to the lock, round piles were driven and braced and a line of 6-in. yellow pine sheeting was driven across the river between the cofferdams in which the lock and the sluices had been built, and cut off at elev. 97, about 3½ ft. below mean low tide. Riprap was then placed and the structure completed as shown by Fig. 1. The lock and the sluices were left wide open during this construction work so as to relieve the shut-off dam as much as possible by allowing the tidal currents to pass through them.

The contract provides that:

As the work of driving the sheet piles and securing them in place approaches completion, the increased velocities of the tidal currents may prevent this work from being carried on except at certain stages of neap tides; and while this work of completion is in progress the contractor will be required to have sufficient pile-driving, dredging and other plant, and tools and workmen, to prosecute this work, and the work of depositing the earth, coarse gravel and riprap at the shut-off dam with such rapidity as may be required.

The driving of the last of the sheeting was difficult, but was accomplished and the sheeting was cut off under water, as evenly as possible so as to make a close joint with the gates. As a further precaution, a piece of rubber hose was nailed on the bottom edge of each gate.

The contract provides further that:

The contractor will be required to put all the gates in place between the first and second of four consecutive high neap tides, none of whose predicted heights, as shown by the tide tables of the United States Department of Commerce and Labor, are more than 9.5 ft. above mean low tide, and when, in the opinion of the engineer, the wind and weather are favorable. He shall

*Division Engineer, Charles River Basin Commission, 367 Boylston St., Boston.

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the gates a short time before low tide, all of the gates in place a short time begins to run up-stream at the dam. A evious to the final placing af the gates, the hall lower each gate into place, and shall fits its place suitably and can be finally out difficulty.

inal lowering of the gates was accomth the tide at about elev. 106.5 and A large force of men was stationed atform built near the top of the gate of the whole shut-off dam, as it appeared a few days before it was closed.

Immediately after the closure of the dam, the basin was drawn down to elev. 105, or about half tide and was held there for about a week, after which it was raised to elev. 108, at which it is to be maintained. The basin is so large and the normal river flow so small that it is not expected the water in it will become fresh until next spring.

TITANIUM STRENGTHENS CAST-IRON quite materially, as shown by tests made for the American Foundrymen's Association and reported at its last convention by Mr. R. Moldenke. Gray iron is strengthened almost 50% (as measured by 12-in. transverse tests of 1¼-in. round bars) while white iron is strengthened but little (20% or less). An addition of titanium alloy giving 0.05% Ti in the casting is sufficient to accomplish the full effect, although more will not be injurious. The deflection at rupture is not increased, but remains about the same as for the same metal having no titanium addition, so that the modulus of elasticity is raised. The chilling power of the metal is slightly decreased by the titanium addition, the chill produced being less deep, but at the same time the chilled portion is harder than the same metal produces without the titanium. For the titanium addition, an iron-titanium alloy containing about 10% Ti, and produced in the electric furnace, was used. This alloy is added in the ladle, the mixture being then thoroughly stirred and allowed to stand long enough to melt the alloy. An alloy containing carbon, say 5%, is somewhat better than one without carbon, as it melts more easily in the ladle.

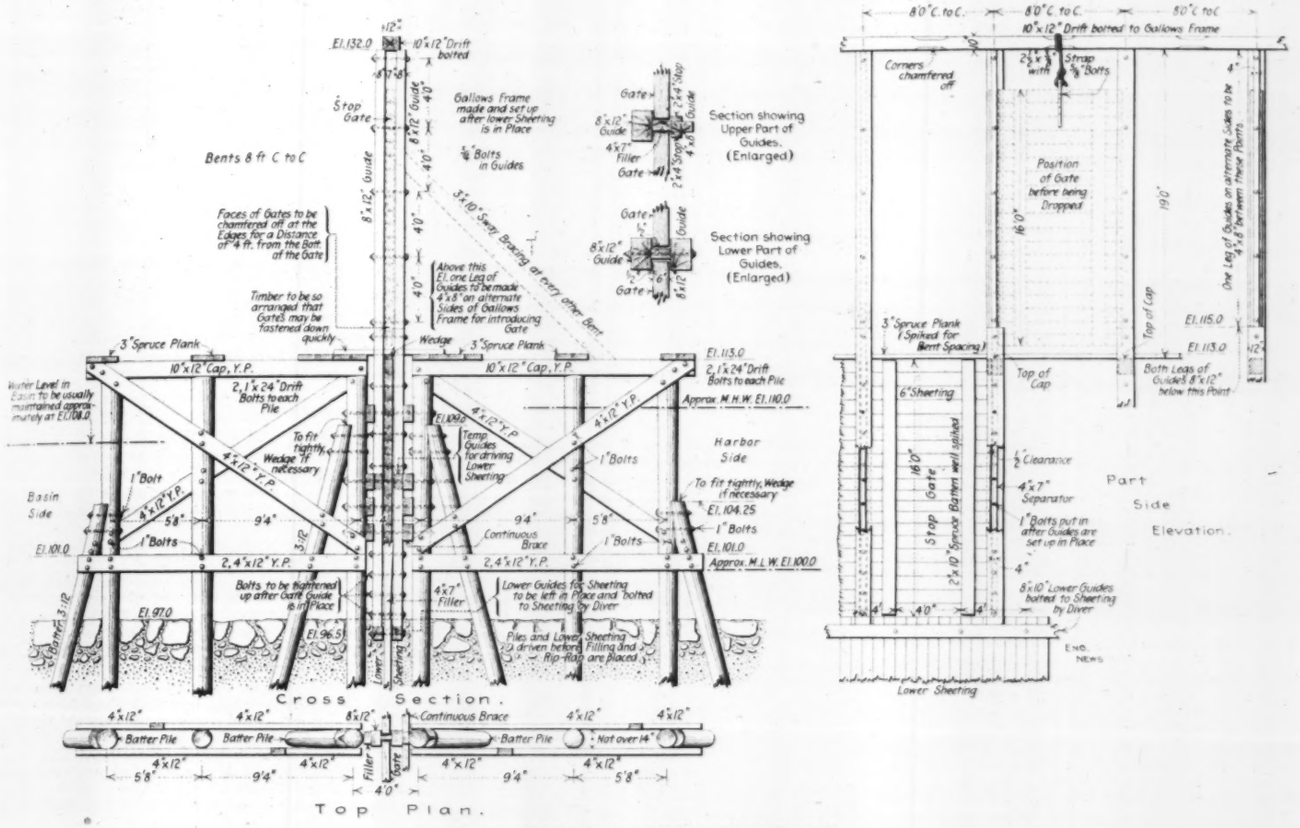
Cross Section.
Top Plan.
Part Side Elevation.
Section showing Upper Part of Guides. (Enlarged)
Section showing Lower Part of Guides. (Enlarged)
Bents 8 ft C to C
Faces of Gates to be chamfered off at the Edges for a Distance of 4 ft. from the Batt. of the Gate
Timber to be so arranged that Gates may be fastened down quickly
Above this El. one Leg of Guides to be made 4"x8" on alternate Sides of Gallows Frame for introducing Gate
3"x10" Sway Bracing at every other Bent
Gallows Frame made and set up after lower Sheeting is in Place
Stop Gate
Water Level in Basin to be usually maintained approximately at El. 108.0
Basin Side
Harbor Side
Batter Pile
Continuous Brace
Filler
Gate
Lower Sheeting
Lower Guides for Sheeting to be left in Place and bolted to Sheeting by Diver
Piles and Lower Sheeting to be driven before Filling and Rip-Rap are placed
Bolts to be tightened up after Gate Guide is in Place
Corners chamfered off
Position of Gate before being Dropped
Top of Cap
Both Legs of Guides 8"x12" below this Point
6" Sheeting
Stop Gate
2"x10" Spruce Batters well spiked
8"x10" Lower Guides bolted to Sheeting by Diver
One Leg of Guides on alternate Sides to be 4"x8" between these Points
Not over 14"

FIG. 1. DETAILS OF THE SHUT-OFF DAM.

guides, and at a signal from the Governor of the Commonwealth, the ropes holding the gates were cut. There was no hitch of any kind, and in seven seconds from the time the signal was given, the gates were all in place. The wedges for holding them down were then driven and spiked into place and a few minutes later a large number of dredges and rehandlers were busy heaping earth against the structure. Fig. 2 shows the shut-off dam at the instant of cutting the ropes, some gates being still suspended, some falling and others closed. Fig. 3 shows a view

The dam is being constructed by the Commonwealth of Massachusetts under the direction of the Charles River Basin Commission, consisting of Hon. Henry D. Yerxa, Hon. Joshua B. Holden and Gen. Edgar R. Champlin. Maj. William S. Youngman is Secretary of the Commission. Mr. Hiram A. Miller, M. Am. Soc. C. E., is Chief Engineer, and Mr. John L. Howard, M. Am. Soc. C. E., Principal Assistant Engineer. The Holbrook, Cabot & Rollins Corporation, Mr. James W. Rollins, Jr., M. Am. Soc. C. E., President, is the contractor for the dam and lock.

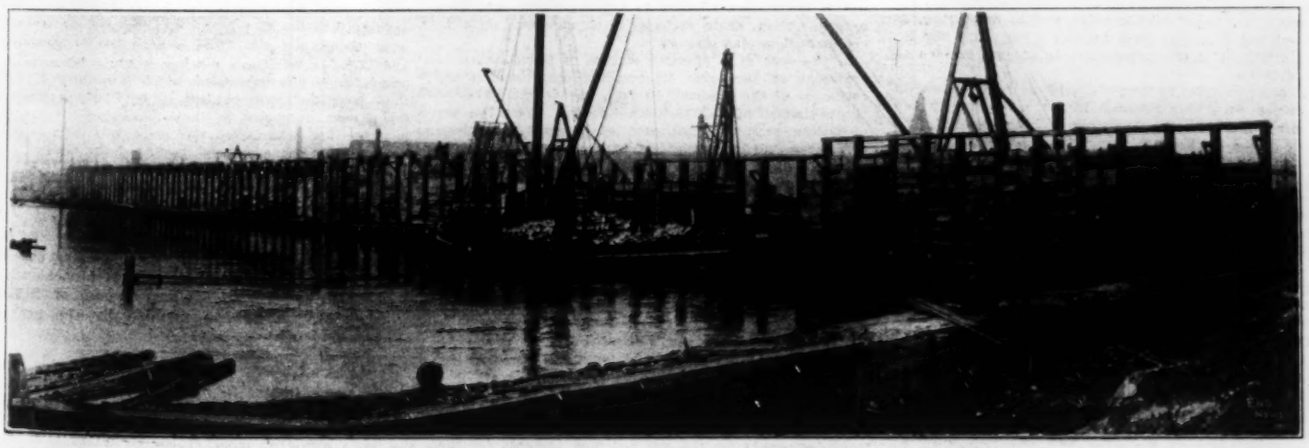

FIG. 3. VIEW OF SHUT-OFF DAM A FEW DAYS BEFORE COMPLETION.

## DIAGRAMS OF TRAIN MOVEMENTS AT STATIONS.*

By L. WEISSENBRUCH and J. VERDEYEN.†

The continual growth of the traffic at large passenger stations has given considerable importance to the problem of the most complete utilization of the tracks. There has been, however, no graphic method for determining how to utilize new facilities to the best advantage. The problem is more difficult than appears at first sight. It is not only necessary to show how the lines are occupied, but also to represent all the movements of trains, and all the switching operations of trains, train sections and locomotives, so as to make it possible to simplify all these movements and operations as much as possible.

Then, also, if there is any irregularity in the service, or if another train is introduced, it must be possible to discover quickly what modification has to be made in the existing arrangements.

A simple method has for a long time been in use on the Belgian State Railways, representing the condition

Fig. 1. Simple Diagram of Train Occupation of Station Tracks.

of the tracks during every moment of the day. The diagram (Fig. 1) has horizontal lines representing the different platform tracks and vertical lines marking the time. Heavy horizontal lines mark the time during which each track is occupied. Thus Fig. 1 shows that track 2 is occupied by train No. 3018 from 8h. 1m. to 8h. 20m.; that track 3 is occupied by train No. 625 from 8h. 5m. to 8h. 25m., and that tracks 1 and 4 are clear.

Thus the official in charge can see at a glance what lines and tracks are clear or are occupied at any given moment.

But this system of representation is very incomplete, for it leaves out of consideration what train movements are incompatible owing to the arrangement of the arrival and departure lines. Nor does it take any note of switching operations. Now it is not of much use to know whether a line is clear, if there is no access to it, or if the train which is to be placed there cannot receive its locomotive at the proper time.

Thus, for instance, if we wish to add a train arriving from a known destination at 8h. 20m., Fig. 1 does not enable us to ascertain on what line it is to be received so as not to interfere with the departure of train No. 3018, which is to take place at the same time.

Mr. Ramaeckers, Secretary-General of the Belgian Ministry of Railways, was the first to grasp the importance of this problem when the Northern station at Brussels was rearranged. He commissioned the signaling department to work out its solution. After numerous trials with different graphic methods which were all very ingenious but too difficult to apply in practice, we adopted a simple improvement on the system mentioned above.

The fundamental principle is to represent the movements on lines parallel to those on which the occupation is marked. The direction of the movements is marked as usual by an arrow. The origin or the destination of the train or of the locomotive is indicated by the number of the arrival line or departure line of the station. Endeavors are made to represent incompatibilities in a simple way, so that it may be easy to discern them. What is required is to succeed in numbering the arrival and departure lines in such a way that any incompatibilities in the movements can at once be seen on the diagram.

In order to make matters clear, let us take the case of a station with four platform tracks, connected by two running lines with the four lines of a junction (Fig. 2). Each of the tracks 1, 2, 3 and 4 has access to each of the lines I, II, III and IV.

1. During the whole time taken by a train in covering the distance AB, certain other movements inside this section are incompatible with the movement we are considering, and therefore cannot be authorized. Thus, for instance, it would not be possible for a departure from 3 towards I and an arrival from IV to 2 to take place simultaneously.

2. It is not possible to authorize movements affecting simultaneously tracks 1 and 2, or tracks 3 and 4.

The running line 1 and 2 being common to the two platform tracks 1 and 2, all that is necessary is to draw one movement line below these lines, which respectively represent the occupation of tracks 1 and 2 (see Fig. 2). The same is done for tracks 3 and 4.

The length of the line representing the movement must necessarily represent not only the time the train takes in covering the distance AB, but also that which elapses from the moment a route is arranged for the train (including the time required for making the route) to the moment the tail of the train has cleared the last crossings of the route.

In the example taken it is easy to see the following:

1. Train No. 3018 arrives at 8h. 1m. from track IV and leaves at 8h. 20m. for track I;

2. Train No. 625 arrives at 8h. 5m. from track II and leaves at 8h. 25m. for track III.

3. Any train which is to arrive at 8h. 20m. cannot come back to track 1, for line 1 and 2 is occupied at that time by the departure of train No. 3018. It may also be seen that the new train may come to track 4 without in any way interfering with the regular service.

The rules to be observed in checking this diagram are as follows:

A. One movement only is possible at the same time on one running line.

B. If we follow down any vertical line, the successive arrows must have different and increasing numerals on them.

The length of the line representing the movement must be ample, so as to allow to a certain extent for any slight irregularities which may frequently occur in practice. The arrival and the departure of trains do not generally take place at the exact moment specified in the time-tables, but within a margin of a minute or even of two minutes. If, whenever this occurred, the diagram would have to be rearranged, the use of the latter would very soon have to be given up. If, on the other hand, the diagram had a certain flexibility, any slight delays would have no influence on the order in which the different movements are effected, and in a very short time, regularity would once again have become re-established, and there would have been no necessity to modify the diagram.

It then remained to distinguish between the different varieties of traffic. We have adopted a black line for trains (by train, we mean a number of vehicles coupled

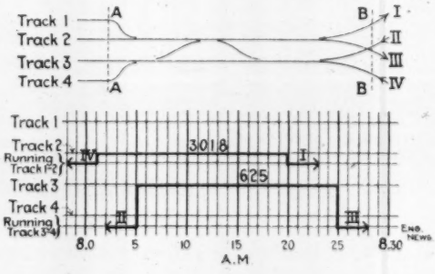


Fig. 2. Diagram of Train Movements and Occupation of Tracks at Stations; Belgian State Railways.

up to a locomotive, and ready to leave the station), a red line for locomotives, and a blue line for train-sections and switching operations. We represent the movements of the switching locomotives of the station by a red arrow with a small circle at its end.

All the regular switching operations which are carried out at the station, whether to add or remove cars from a train-section, or to exchange a through car, must be represented on the diagram.

In the case of a roadside station, it is necessary to represent on the same diagram the operations at the two ends of the station. In fact, the determination of the utilization of any platform line can depend on the operations carried out at each of its ends. As these movements are independent of each other, they must be represented on separate running lines and marked in such a way as to avoid any confusion.

With this object in view, Roman numerals are used to designate the movements at one end, and letters those at the other. It would also be possible to use two different alphabets (ordinary letters and Greek letters), or Roman numerals for one end and Arabic numerals are already used for the platform lines.

If numerals and letters have been selected, the rule B can be expressed clearly as follows:

If we follow down any vertical line, the successive arrows must have different and increasing numerals on them. If we follow it upward, different letters succeeding in their alphabetical order.

It will be very easy then to examine the two ends of the station simultaneously, by following the vertical lines downwards for the one end, and upwards for the other end.

*Abstract of a paper in the September "Bulletin of the International Railway Congress." The paper describes in detail the application of the system to a number of individual stations, but we have confined our abstract to the general principles (Ed.)

†Superintendent of Signaling and Assistant Superintendent of Signaling, respectively, of the Belgian State Railways, Brussels, Belgium.

## A RECOMMENDATION FOR PARKING CITY STREETS AT RIDGEWOOD, N. J.

The improvement of Ridgewood, N. J., has been reported on before the Board of Trustees of that village by Mr. Charles Mulford Robinson, of Rochester, N. Y. The report deals particularly with improvements in the street plan and the provision of adequate "parks, parkways and recreative facilities." New streets on the radial principle, centering in the railway station, are suggested, as well as the creation of a civic center. The sidewalks of the village are characterized as "the saddest feature of Ridgewood." The principal fault, in Mr. Robinson's opinion, seems to be that most of the walks are placed within 12 to 18 ins. of the curb, leaving inadequate space for trees and grass. For a place like Ridgewood, it is suggested that on residential streets 60 ft. in width between property lines, there should be 3 ft. of turf between the property line and the sidewalk, a walk 6 ft. in width, and then 10 ft. of turf between the walk and the curb, the latter "strip carrying the street trees and in some cases further ornamentation with flowers and low shrubs." This would leave a 22-ft. roadway, which "is wide enough for any residential street in Ridgewood that is not arterial, or that does not carry a heavy pleasure traffic." On the general subject of width of residential streets and utilization of a portion of the width over all for parking purposes, Mr. Robinson may be quoted as follows:

It is to be noted in this connection that the width of few wagons exceeds 8 ft. over all, and it is a very big touring car that reaches 7 ft., so that an 18 to 20-ft. road allows ample room for passing; and where the road is divided as proposed by a middle strip of parking, all the traffic on each side is in the same direction—reducing to a minimum the need of passing.

But it must not be thought that good looks furnish the only argument for this sort of street development. The economic argument is strong. The wide roadway is much more costly than the narrow, both to construct and to maintain. From the financial standpoint, then, there should be a desire to make the roadways as narrow as the traffic will permit. Taking the sanitary point of view, the wider the road the greater the volume of dust, and the closer the road comes to the curb the nearer the dust is to the houses and to pedestrians. The more likely, too, are the latter to be spattered with mud if there be mud instead of dust. Finally, the enhancement of the street's beauty by a broad strip of turf between walk and curb lies not only in the substitution of grass for macadam—or whatever the pavement may be, but to a very important degree in the better chance for life and vigor that is thus given to the trees. When trees are planted in a strip only a few inches wide, as on most Ridgewood streets, one of two unfortunate things must happen. Either the trees will prove puny and sickly, and will ultimately die for lack of nourishment; or, if through the energy of those roots which get under adjoining gardens the tree grows large and flourishes, it forces up the walk and throws the curbing out of plumb. Again, as the wide parking is easier to take care of than the narrow, its esthetic effectiveness, even without considering the trees, increases in greater proportion than its width. There is also a better symmetry to the street as a whole. A strip here that is only a few inches wide is too weak to play the part it should and irritates by its lack of balance.

As to the attitude of the householder, if none of these arguments convince him, he may further reflect that a wide parking seems to increase the depth of his own lot and gives to his house a better setting. There is, too, something in the impression which is made by a street thus beautified that renders it peculiarly appropriate for a town developed by those who have left the city in order that—while work still daily calls them thence—the peace, spaciousness and beauty of the country may be theirs. The poorest resident, traversing a street thus developed, can feel a proprietary interest in the street lawns and noble trees. He does not have to look over a fence at somebody else's grass. It is his, by virtue of his residence in the town. He has got the thing he came for.

Street jogs, or "the failure of cross streets to make direct connection," Mr. Robinson says, are a bad feature of the street plan of Ridgewood, which might be avoided by the use of curves.

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CABLE RAILWAYS in Chicago will soon be a thing of the past. Out of 35 miles of cable roads existing when the work of rehabilitation was begun a year and a half ago, 30 miles have now been removed. During the same period 42 miles of electric tracks have been rebuilt.

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We have given no space in this journal thus far to the investigation which was made last month by the Inspector General's office in Washington into the award to the Lidgerwood Mfg. Co. of the contract for the cableways to be used on the Gatun locks. We believed that the engineering profession as a whole has such entire confidence in the absolute probity as well as the competence of Col. Goethals and his staff of engineers that it was unnecessary to report in detail the investigation which was made.

Now that the investigation is completed, however, and the findings made public, it is proper to record the results, which are in brief to absolutely and entirely exonerate Col. Goethals and his associates. Not a scintilla of evidence was presented to indicate other than straightforward dealing by the Isthmian Canal engineers in every step connected with the cableway contract. Nor was there on the other hand, any evidence presented in any way implicating the Lidgerwood Company or its staff as having acted in any other than an honorable business manner, in all matters connected with the cableway contract.

And we should fall short of our duty to the profession were we to stop here. It is not enough merely to exonerate the canal engineers and the successful bidders from the charges of dishonor and dishonesty. We leave it to the profession what sort of condemnation and contempt should be adjudged to those who recklessly set afloat charges involving the honor and honesty of reputable engineers and reputable engineering concerns.

Such charges, with the newspaper publicity that attends them, do injury to the whole engineering profession and not alone to the profession but to the commercial side of engineering work. A million careless readers among the general public scan newspaper headlines enough to glean in a general way that there is some scandal concerning a canal contract, and they never follow the matter further to learn that the scandal had no foundation in fact. If, therefore, the concerns which were responsible for the bringing of these baseless charges meet the general reprobation of engineers, they cannot complain that their punishment is unmerited.

There is too much, far too much, careless blackening of character current among engineering commercial circles; but we cannot see why high professional standards should not be insisted upon there. If a concern which circulated unfounded charges of dishonesty concerning a competitor were to have visited upon it the outspoken condemnation of the trade, there would be fewer careless and ill-founded stories afloat. What is more important still, the outside public would not have its confidence in engineers and their honor so frequently and needlessly shaken.

In a recent issue of Engineering News we published a report* on the relative corrosion of wrought iron and steel pipe of large diameters where the pipes themselves were made up of riveted plates of wrought iron and steel. In the opinion of some investigators, wrought-iron made from puddled pig is far more durable under these conditions than "steel." On the other hand, the researches of a few well-known investigators, holding responsible positions, show that, in the case of pipes of small diameter made from skelp, there has been no better behavior, in service, of wrought iron than of steel. Both have been corroded at times, and they have both been good at other times in a puzzling way. The claim of the steel makers to have evolved a more homogeneous skelp that will be more resistant to corrosion is worthy of careful attention. The frankness with which Mr. Speller, in the paper reprinted elsewhere in this issue, showed the limits of the improvement went far to convince his hearers, mostly users of gas pipes, of the genuineness of his claim of having secured an improved steel pipe that was more durable than wrought iron.

It is a rule of long standing with Engineering News not to publish descriptions of new inventions until they are actually put into concrete shape and subjected to some sort of trial. We break over this rule in this issue to present a description by Mr. Frank Richards, well known in the field of compressed air engineering, of an invention which he has devised for automatically varying the output of an air compressor with variations in the demand for air.

We do not vouch, of course, for either the novelty or the merit of Mr. Richards' idea. The Patent Office searchers will have to pass on the one and only practical trial will settle the other. We feel justified in printing the article, however, because the questions which Mr. Richards raises will interest, we believe, all engineers interested in compressed air work. The point on which discussion will chiefly turn, probably, is whether large clearance space in an air compressor cylinder is hurtful to its economy. If it is hurtful, then Mr. Richards' device will not recommend itself. If, on the other hand, as seems reasonable to believe, the air in the clearance space acts like a perfect spring, giving up to the piston in expansion as much as it absorbs in compression, then Mr. Richards' appliance would seem to promise a notable advance in the art of air compression.

The use of motor cars to operate branch line service and to operate an auxiliary local service on short sections of main lines has been introduced on many railways in Europe, and has been experimented with in this country. The cars are usually operated by steam or gasoline engines, and in a few cases the engine drives a generator supplying electric current to motors. A German railway has been using storage-battery motor cars for some 15 years, operating both of the classes of service noted above, and has obtained results that are very favorable from both the operating and the economic points of view. Elsewhere in this issue we present some details of this service, taken from a paper written by the chief mechanical engineer of the railway in question. There are, however, certain limitations to the successful operation of storage-battery cars, as shown by the paper: 1, the lines must be comparatively level and not too long; 2, they must be convenient to charging stations at points where current can be produced cheaply; 3, careful supervision of the batteries must be maintained, to ensure their economical service.

Two special features of operation are employed on this railway to attain high efficiency and economy in the batteries. In the first place, a car with new batteries is operated on one of the more important sections until its battery capacity is reduced, and is then transferred to a less important section until a renewal of the battery plates is necessary. In the second place, the cars are in some cases hauled between certain points by the regular steam trains, thus increasing the range of operation (from the charging station) and reducing the work required of the battery. The storage-battery system for motor cars has proved satisfactory under the conditions in this case. These include a heavy local traffic between a group of towns, the ready supply of charging current, the favorable grades and lengths of the several runs, and especially the great care taken to obtain the highest possible life and service from the batteries. Without such a combination of favorable conditions, the storage-battery car would make but a poor showing. This combination is necessarily somewhat exceptional, and for this reason the simpler and more flexible system of the self-contained steam or gasoline motor car is more generally employed in service of this kind. The features of care in operation, and the utilization of opportunities to promote efficiency and economy, may, however, be applied in any case. For this reason especially, the paper noted above is worthy of careful study by those having motor-car or auxiliary train service under their charge.

*The corrosion of the steel water-supply conduit at Rochester, N. Y., by Richard H. Gaines, Engineering News, May 28, 1908.

## ELECTIONS AND ENGINEERS.

When this number of Engineering News reaches its readers, the Presidential election of 1908 will have passed into history. Its final result will probably be known, from one end of the nation to the other, within a few hours from the time when the ballot boxes on the Pacific Coast are closed. Indeed, owing to the difference in time between the East and the far West, it is quite possible that a forecast of the result may be made from the first returns in doubtful States of the East, while voters in California are still casting their ballots.

It is a remarkable spectacle—a nation of over eighty million people choosing their chief ruler by a popular vote. Nowhere else in the world is there held an election of any such magnitude. Among the nations, only Russia possesses territory and population comparable with the United States and she is only now taking the first steps in self-government which were taken by the English-speaking race centuries ago.

It is interesting to reflect that this marvellous extension of popular government has been made possible by the achievements of the inventor and the work of the engineer.

The art of printing, and the resultant spread of popular education and increase in popular intelligence; the spread of the railway and the telegraph; the rise of the newspaper—these are some of the ways in which it has become possible for eighty millions of people spread over 3,000 miles of territory to exercise something like intelligent choice between the candidates for the highest office in the land. Indeed it is not too much to say that popular government on the scale that we have it to-day, could not have existed in the world as it was in the Middle Ages. Experiments in popular government were made, indeed, far back in history, but they always degenerated into failure. Even had other conditions been favorable, there was no possible machinery by which the great body of the electors could be sufficiently informed of the merits of competing parties or candidates to enable an intelligent choice.

It is common enough to hear it said, as the excitement of a hotly-contested political campaign passes away and people adjust themselves to the result, that it will after all make no great difference which side is victorious. Whichever

party wins, the daily routine of life—eating and drinking, buying and selling—will go on very much as usual.

But while this may be and often is true, the public interest in a great election is more than justified by its relation to the public welfare. We speak lightly of "life, liberty and the pursuit of happiness," and think of them as the common and natural possession of every man under a civilized and enlightened government. But if we study the history of past centuries or even of the conditions under which a large portion of the race exists today, we find that the enjoyment of the blessings which we take as a matter of course is far from common. A large part of the world's population still lives under conditions where life and property are insecure and this insecurity is due to inefficient government. But efficiency of government is closely dependent on the choice of rulers. If we in the United States have been more successful in the great experiment of popular government than other nations which have tried it, it is largely because we have been able to choose public officials who have been on the whole more honest and more competent.

And it is a misnomer at the present day to speak of popular government as an experiment, even though it was so regarded by the world a century ago. Whatever the difficulties in the choice by the people of their own rulers, the nations will never return to the ancient plan of hereditary rule. The reason for its existence passed away when government came to exist for the benefit of the people and not for the benefit of the king. It was natural enough that a king, who virtually owned his subjects, should bequeath them to his son like any other property; but in all civilized countries, even those where absolute monarchy prevails, it is freely accepted that the government exists for the benefit of the subjects and not for the benefit of the king and his court. While it is true that hereditary monarchy still exists in some countries of most advanced civilization, it has been shorn of its ancient powers. The forces which maintain it are reverence for past customs and conservative opposition to innovations. It exists only as organs of the body persist for a time after their usefulness has departed, and like them, atrophy is bound to be its ultimate fate.

There is no escape from the conclusion, then, that the people must make choice of their own rulers. How they can be enabled to make wise choices is one of the greatest problems that our civilization faces. And it is a problem that grows more and more important with every passing year. The rapidly growing complexity of our industrial world is forcing the people by the stern logic of events to steadily increase governmental functions. The old theory that "that government was best which governed least" was formulated in a world absolutely different from that in which we live today. The theory of the anarchists that government should be abolished entirely and each individual left free to follow his own inclination has had practical application in the life of savage races, just as the theory of the "Laissez Faire" school of political economy had practical trial in the days of primitive industry. Both of these theories fail utterly when applied to the dense populations and complex social and industrial conditions of the 20th century.

It does make a difference—a vast difference—who is nominated and elected to public office. A large proportion of our knotty problems of the present day resolve themselves in the last analysis to the question how to get men of ability and integrity into the places of authority. Not only is this true of our governments, national, state and municipal. It is equally true of our great corporations; equally true of our labor unions. To take a single striking example,—it is only a few months ago that a million holders of life insurance policies were holding an election to choose trustees to care for property aggregating many hundreds of millions of dollars in value.

It was well asked how could these men, scattered all over the country, cooperate with each other in nomination and election and exercise a wise and intelligent choice in the selection of men of whom not one policyholder in a hundred had any personal knowledge. Yet it was well worth while to attempt such a selection rather than permit cliques of irresponsible New York financiers to use the money of the great life insurance companies as if it were their private property.

For another illustration take some of our great railway systems and huge industrial corporations. Their real owners are the thousands of people who hold the bonds and stocks, but the control is absolutely held by a small circle of capitalists who find ways to perpetuate themselves in power and use their powers in various ways for their own personal profit and not for the benefit of the real owners of the property.

We have referred in our heading to engineers and their relation to elections. They have the interest that all good citizens have in securing the best men to fill official positions and in addition they have an intimate relation, such as no other profession has, to the work which the government carries on. A competent and honest government in a city or a state means that the engineering work carried on under the government direction will be carried on by competent and honest engineers. It means that appointment and promotion will depend on ability and efficiency and not on political pull. It means—not seldom—that an engineer will not have to face the disagreeable alternative of either losing his position and means of livelihood or else shutting his eyes to frauds upon the public or even joining in their commission.

It is true that many engineers are obliged by necessity to lead a peripatetic life, living only a few months to a few years in one locality and are thereby much handicapped in political activity. None the less is it true that the engineer, as a man of education and affairs ought to take a prominent part in political life as a duty to his country and his profession.

None will dispute that high profesional standards ought to be furthered by engineers; but it is only possible to advance such standards—to do the highest class of professional work—when honor and honesty are the rule in the higher positions. To take a concrete illustration: The whole country and the whole profession is proud of the work which the Reclamation Service has done in the West; but it would not have been possible to organize and conduct this great work on such a high professional plane save for the hearty support of President Roosevelt. Indeed, we may go further and say—what, indeed, is common knowledge among engineers—that in no previous administration has the work done by engineers under the Federal Government attained such high efficiency and been so free from the interference of political corruptionists.

Exactly the same principle holds with respect to engineering work done for private corporations. If you want to find examples of high class engineering work, you do not go to the railways which have been made a Wall Street football, or to the mines which are exploited to extract money from confiding investors. In all these cases honesty and efficiency in the ruling heads is a prerequisite to honest and efficient work in the office and shop and field.

Engineers, then, have even more than the ordinary citizen's interest in elections. They ought to be not only interested in politics—using that word in its proper sense—but conversant with the best thought respecting the difficulties in the way of securing intelligent choice by the electorate, and the best means of reducing them.

How great these difficulties are, engineers can especially appreciate, because they know how essential expert knowledge and training is to the performance of good work. The idea is still widely prevalent in the public mind that almost any man who can be popular and can draw votes is competent to hold almost any public office. It is to this idea that much of the inefficiency of work done under the Government can be traced. Every engineer knows how absurd it would be to apply this rule to private business. In any mercantile or manufacturing establishment, commercial success is well known to depend more than anything else on the selection of the right men to fill the places of responsibility. And how difficult a task this is, even when [illegible] with a perfectly free hand! Let [illegible] over the list of those whom he of [illegible] edge knows to be competent and [illegible] positions of high responsibility. [illegible] short the list will be! Then assume [illegible] lection to be made is of a man [illegible] specialty and see how the difficulty [illegible]

There are two general theories of [illegible] ernment, commonly called the republ[illegible] democratic, although they have long [illegible] identified as the policies of those [illegible] Under the first plan, popular electi[illegible] to the more important offices and of[illegible] are filled by appointment. Under th[illegible] so-called democratic plan, the people [illegible] on the candidates for all the offices.

We risk little in saying that the [illegible] desired—securing competent men in places of [illegible] ity—is far more apt to be obtained [illegible] secondary places are filled by appointm[illegible] instead of by election. To take a concrete illustration, the people of a city may in the long run and on the average choose good men for the office of Mayor, but if the office of City Engineer is put up for popular vote, the chances are strong that political pull and not engineering ability will govern the selection.

And the same rule applies to all the positions in which expert ability is required. In New York, during the campaign just concluded, the argument has been brought forward that the members of the Public Service Commission should be nominated and elected by popular vote instead of appointed. Let anyone who is attracted by this idea seriously inquire what are the methods by which the delegates to a political convention selects the candidates to be placed in nomination. Assume that all the delegates are honest and are sincerely desirous of selecting the most competent men for the positions to be filled. How can these hundreds of delegates hunt up the men who have the special competence to fill such positions as those on the Public Service Commission and who are at the same time available for the place? To ask such a question is almost to answer it. Beyond question we shall advance toward better government by following the plan which the best experts in municipal reform agreed on twenty years ago. Reduce the number of elective offices and increase the responsibility in the hands of the Mayor and similar chief officials.

## LETTERS TO THE EDITOR.

### Prehistoric Records of Low Water in the Ohio River.

Sir: During the recent dry season when the Ohio River and its tributaries broke all former records of low water, the local press called the attention of the public to the so-called "Pictured Rocks" in the bed of the river, near Smith's Ferry. These consist of crude outlines of animals, birds and fishes, and, beyond a doubt, were placed here when the head waters of the Ohio and its tributaries knew no trace of civilization, and they stand as undisputed testimony in the discussion of the relation of forests to stream flow in the Appalachians.

It is not probable that the people making these pictures made them in a place so rarely accessible as are these rocks during recent years, but even granting that they did, the fact that they are in a place that now only the most extreme dry weather lays bare proves that the removal of forests to the extent now existing along the head waters of the Ohio and its tributaries has not decreased the dry weather stream flow as has been the popular fallacy, but if any change has come about the balance of evidence would show an increase.

Yours truly, F. G. Ross.

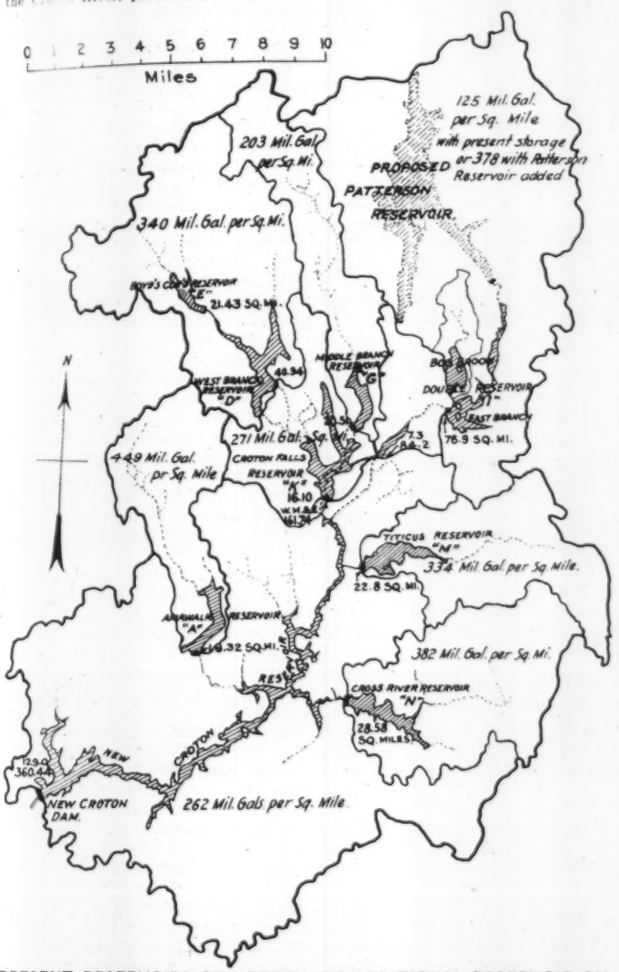
Farmers' Bank Building, Pittsburg, Pa., Oct. 30, 1908.

### Should Additional Storage Reservoirs Be Built in the Croton Drainage Area?

Sir: From Nov. 6, 1907, to June 8, 1908, nearly 80 billion gallons of water wasted over the spillway of the New Croton Dam. This loss, at a time when the warning of a water famine has been frequently sounded in New York, gives rise to the question: Could not some, if not all, of the water wasted since last November have been conserved for the water supply of the City of New York? As most of your readers doubtless know, New York has gone to the Catskill Mountains to obtain a new supply of water, but it is estimated that it will take five years, if not, indeed, a considerably longer period before the city will derive any benefit from this source of supply. It is, therefore, of the utmost importan

that the Croton drainage area, which now supplies New York, be utilized to its utmost capacity.

On the accompanying map of the Croton drainage area there is shown the storage in millions of gallons per square mile which has been thus far provided by the existing reservoirs and one now under construction at Croton Falls, which will be completed by Jan. 1, 1910. An examination of this diagram shows that whereas the present storage for most of the sub-divisions of the Croton drainage area amounts to 260,000,000 to 400,000,000 gals. per sq. mi., thus far a storage of only 125,000,000 gals. per sq. mi. has been provided on the East Branch of the Croton River. As no good reason can be given why all sections of the Croton drainage area should not be equally developed as regards storage, it is advisable to construct another reservoir on the East Branch of the Croton River, provided a suitable site can be found,


0 1 2 3 4 5 6 7 8 9 10
Miles
125 Mil. Gal. per Sq. Mile with present storage or 378 with Patterson Reservoir added
203 Mil. Gal. per Sq. Mi.
PROPOSED PATTERSON RESERVOIR.
340 Mil. Gal. per Sq. Mi.
RYE'S CLOVE RESERVOIR "E"
21.43 SQ. MI.
MIDDLE BRANCH RESERVOIR "C"
BOG BROOK
DOUGLAS RESERVOIR "I"
EAST BRANCH
76.9 SQ. MI.
WEST BRANCH RESERVOIR "D"
271 Mil. Gal. Sq. Mi.
449 Mil. Gal. pr Sq. Mile
CROTON FALLS RESERVOIR "K"
N
TITICUS RESERVOIR "M"
334 Mil. Gal. per Sq. Mile.
22.8 SQ. MI.
ANGMAR "A" RESERVOIR
382 Mil. Gal. per Sq. Mi.
CROSS RIVER RESERVOIR "N"
28.58 SQ. MILES
NEW CROTON DAM.
262 Mil. Gals per Sq. Mile.

PRESENT RESERVOIRS AND PROPOSED ADDITIONAL RESERVOIR ON CROTON DRAINAGE AREA, NEW YORK WATER SUPPLY; SHOWING STORAGE PER SQUARE MILE ON EACH SUBDIVISION OF THE DRAINAGE AREA.

where such a storage basin could be built at a reasonable expense in two or three years.

In a report dated March 2, 1908, Mr. Walter H. Sears, M. Am. Soc. C. E., Chief Engineer of the Aqueduct Commission, recommended that an additional storage basin of 20,000,000,000 gals. capacity be constructed on the East Branch of the Croton River, at Patterson, Putnam County, N. Y. This would raise the available storage on the East Branch to about 378,000,000 gals. per sq. mi.—a figure in keeping with the development of the other portions of the drainage area. The proposed reservoir, which is shown on the accompanying map, can be formed by constructing an earth dam with masonry spillway, together, 1,050 ft. long, having a maximum height of 40 ft. above the surface of the ground, and by building, also, two small dikes: one 1,000 ft. long and 25 ft. high and the other 250 ft. long and 18 ft. high. Mr. Sears estimates that this reservoir could be constructed in two years, at an expense of about $3,250,000. The recommendation of Mr. Sears, to build the proposed reservoir, was fully indorsed by Prof. William H. Burr, Expert Engineer for the Aqueduct Commission, and, also, one of the Consulting Engineers of the Board of Water Supply of the City of New York.

What is the probability of there being sufficient rainfall to fill all the existing reservoirs, and, in addition, the one proposed at Patterson, allowing, to be safe, three years for its construction? The writer has investigated this question very carefully, both by calculations and by diagrams, beginning with the depletion of the reservoirs that existed on Jan. 1, 1908, and assuming the records of rainfall and runoff, kept in the Croton drainage area from Jan. 1, 1868, to Jan. 1, 1908, to be repeated. The daily consumption of Croton water in New York, which averaged, last year, 325,000,000 gals., was assumed to be increased each year by 12,000,000, in accordance with the experience of the past years. The studies made showed that, beginning with the rainfall of each year since January, 1868, and considering the three years following to allow sufficient time to build the Patterson reservoir, there would be sufficient runoff in the Croton River to fill the existing reservoirs and, also, the one at Patterson, in 16 out of the 40 years of record of rainfall and stream flow, and that in some of these years the Patterson reservoir could be filled twice. Considering only the past ten years, which have had considerable rainfall, we find that the Patterson reservoir would be filled in seven out of ten years, and in an additional year it would be partly filled.

Taking the depletion of reservoirs that existed on Jan. 1, 1908, and considering only the cycles of years when the rainfall was least, the writer found that although the reservoirs would be completely emptied in cases of excessive droughts, they would in every case, be eventually filled again. In making these studies, of course, the depletion curve was not continued below the line indicating "all reservoirs empty," and the consumption of Croton water was not taken at more than 400,000,000 gals. per day, as that is the utmost that could be delivered by the old and new Croton aqueducts, which now supply the city. At the present rate of increase of consumption, six years will elapse before more than 400,000,000 gals of water per day will be required in New York, and by that time water from the Catskills or some other source will have to be introduced, if the consumption is to continue to increase as at present.

If the Patterson reservoir be built it can be filled even in a year of drought, as it will be the farthest up-stream basin on the east branch of the Croton River and will be supplied from a drainage area of about 56 sq. mi. The worst thing that could happen would be that in a cycle of very dry years some of the reservoirs lying below the one at Patterson would only be partially filled, or not filled at all. Weeds and bushes would doubtless grow in the empty storage basins, but the expense of cutting these would not be very large and in the next wet cycle of years all reservoirs would be filled and 20,000,000,000 gals. of water would be conserved for the city's use that without the Patterson reservoir would waste into the Hudson River.

Croton Lake, the largest of all the reservoirs in the Croton drainage area, lying below the proposed storage basin at Patterson, will be crossed by the aqueduct from the Catskills, from which it may be filled in seasons of drought, when the supply from the Croton drainage area may prove to be insufficient.

Some objections have been made to the construction of the Patterson reservoir. It has been claimed that as a considerable portion of the site of this reservoir is covered by swamps the water in the reservoir would be unfit for use for some years on account of the decomposition of vegetable matter.

In answer to this it may be stated that all of these swamps drain at present into the East Branch of the Croton, whose water they discolor, and that to cover them with 10 to 15 ft. of water will rather be beneficial than otherwise.

According to Prof. William P. Mason, a well-known authority on water supply, water from swamps has, as a rule, no serious effect on the health beyond causing in those unaccustomed to its use mild enteric disorders.

In the case of the Patterson reservoir it must be borne in mind that it would only be one of twelve reservoirs supplying New York, and that as its water would be mixed with that from the other storage basins it would be harmless. This was the experience made by the City of New York when the Bog Brook reservoir, which covered some swamps, was put into service.

Another argument advanced against the construction of the Patterson reservoir is that it would increase considerably the percentage of water surface in the Croton drainage area and would thus cause much additional loss of water by evaporation. The answer to this statement is that the loss by evaporation from the present swamps is probably not much less than it will be from a water surface and, as a matter of fact, the swamps are generally covered in the spring of the year by water so as to form practically a lake.

To sum up: New York City can build in two years a reservoir at Patterson, in Putnam Co., New York, capable of storing 20,000,000,000 gals., at the very reasonable expense of $3,250,000. This additional storage, which will supply the city for about 55 days, may avert a water famine that may occur before the supply from the Catskills is obtained.

The worst that can happen would be that in a cycle of very dry years, all of the reservoirs in the Croton drainage area could not be filled. The money invested in the Patterson reservoir would, nevertheless, be well spent, as it would serve to store 20,000,000,000 gals. of water from wet years for dry years, increasing thereby the minimum yield of the Croton drainage area by about 12,000,000 gals. per day.

In the City of New York the death-rate and loss of property by fire would be greatly increased by a water famine. This danger may be avoided by building the Patterson reservoir, and if, on account of a cycle of very dry years, this expectation should not be realized, New York will simply not derive an immediate benefit from the investment of $3,250,000.

The value, however, of the Patterson reservoir in increasing the yield of the drainage area will remain. In view of the importance of the issue involved it would seem unreasonable to hesitate to build the Patterson reservoir merely because there is a possibility of a prolonged drought occurring.

Respectfully,

Edward Wegmann, C. E.

280 Broadway, New York City, Oct. 16, 1908.

## Large-Size Exposure Tests of Concrete in Tidal Water

Sir: You published a letter from me in your issue of Sept. 24 regarding the disintegration of concrete between tide levels. I note another letter on this subject with an editorial endorsement in your issue of Oct. 22.

In order to get some standard tests on this subject, this company (The Aberthaw Construction Co., of Boston) has obtained permission from the Navy Department to construct in the Navy Yard at Charlestown, Mass., concrete piers made of various mixtures of concrete and of different brands of cement, these to be placed in such a position that they can be photographed, at the water's edge, so that the base will be entirely submerged and the shaft come above high tide, all to be properly marked and recorded. We have associated in this, Mr. Herbert L. Sherman, Cement Chemist, of 12 Pearl St., Boston, who will make careful analysis tests and records of cement and aggregates.

The Aberthaw Construction Co. is prepared to spend whatever money is necessary to make these tests of value and would be glad to get suggestions regarding the arrangement, the mixes, and the material to be used in the various piers from such engineers as are interested in the subject; and we would be glad if you would give this matter attention in your paper and request that any suggestions regarding this matter be sent in promptly to this company. We wish to make these samples as useful as possible to the engineering community at large, and believe that in the course of a few years we should be able to establish some general principles regarding the effect of freezing and thawing and the general action of salt water. As I suggested in my letter, it is my belief that the subject of porosity in concrete masonry has been treated much too lightly, and that some tests along the line suggested will prove of very great use not only to this company but to any engineers interested in first-class concrete work.

Yours truly,

Aberthaw Construction Co.,

By M. C. Tuttle, Secy.

8 Beacon St., Boston, Mass., Oct. 22, 1908.

[We trust that those in position to make valuable suggestions in line with the above request will forward them to Mr. Tuttle. This applies on the one hand to suggestions for proper procedure and precautions required to make the results most broadly valuable, and on the other hand to suggestions for methods and devices

to be tried as preventives or palliatives of the intertidal disintegration. Since exposure tests are primarily comparison tests, their chief result will be the comparison observations on the different materials, mixtures, consistencies, etc., which are separately represented. It is very much more difficult to compare results obtained here by one method, with results subsequently observed elsewhere on other concretes, etc. This means that it is highly desirable to include in the one series of tests, where the same external conditions affect all the samples, every promising method or procedure and every commonly-used mixture or kind of concrete. On this ground we trust that a comprehensive range of suggestions will be forthcoming in response to the above letter.—Ed.]

### Notes and Queries.

Referring to the steel stacks erected at the Crocker-Wheeler Works at Ampere, N. J., and described on p. 447 of our issue of Oct. 22, we are informed that the work of erection was done by the Dover Boiler Works, which constructed the stack.

In the article on the raising of the Chicago & Oak Park Elevated Ry., in our issue of Oct. 29, the cross-section of the Lake St. bridge in Fig. 5 showed the structure as having timber chords. This was a draftsman's error, the bridge being a steel structure, as stated, and as shown in Fig. 6.

S. B. F., ——, Miss., inquires concerning the legal position of a contractor who suffers loss through the suspension of work ordered by the party giving the contract. He desires to know of any cases where a railway contractor has been allowed any remuneration, either as cash indemnity or as rental on an idle outfit, to reimburse him for losses caused by the suspension or annulment of a contract by a railroad company.

Our attention has been directed to three errors in the summary of the revised estimate of the cost of construction of the proposed Boston & Eastern R. R., in the article by Mr. H. S. Knowlton, in our issue of Aug. 20. The item "cut east of High Rock" should read $352,880 instead of $325,880. The item "culverts" left blank should be placed at $10,000 and the total cost should read $1,241,490 instead of $1,241,900. The errors were due to the stenographer who made the original report.

## THE PROPOSED RESERVOIR SYSTEM IN THE OHIO RIVER BASIN.

### A Reply to Major H. C. Newcomer, Corps of Engineers, U. S. A.

By M. O. LEIGHTON,* Assoc. M. Am. Soc. C. E.

It seems advisable to submit a few statements in reply to the article of Major H. C. Newcomer, Corps of Engineers, U. S. Army, which appeared in Engineering News of Oct. 8, 1908. It should be understood at the outset that this reply is not made for purposes of mere controversy. The importance of the subject and the necessity for well-advised procedure in the future warrants thorough and judicial review. In addition to this, the distinguished author of the article has apparently received some erroneous impressions, which should not be perpetuated.

Major Newcomer introduces his discussion by a quotation from M. A. Troté, of the "Ponts et Chaussees," who characterizes the reservoir system for the protection of low lying land as "seductive" at first glance but productive of serious difficulties. This opinion would be more conclusive if it had the unanimous support of his colleagues, but it appears that European opinion concerning this matter is no more harmonious than that in America. René Tavernier, Chief Engineer of the "Ponts et Chaussees," expressed in a recent interview with the writer an opinion quite the opposite of that quoted in Major Newcomer's article. He cited certain rivers in which the reservoir system would have been used for flood control if proper foundations for dams could have been found. He discussed the matter at length and gave every evidence that he regarded the reservoir principle as sound and practicable in the prevention of floods.

A quotation from a foreign authority is always impressive, but it frequently fails to be conclusive, and it is by no means a reflection on foreign engineering to state that some of the greatest epochs in American engineering have been the result of bold disregard of the opinions, ideas, and conventions of foreign engineers. Examples are numerous, but we need go no farther back than the determination of the type of the Isthmian Canal to cite an instance of disagreement. Yet, Major Newcomer's fellow officers are now constructing a lock canal, with great enthusiasm and unexampled success. Therefore, if we may take cognizance of the past, the adverse opinion of foreign engineers, even though it be unanimous (which in the matter of reservoirs it is not) does not bring utter condemnation to an American engineering plan.

Some reply should be made to Major Newcomer's observations on the personnel of the Inland Waterways Commission. Although delivered with a gloved hand, they do, nevertheless, reflect upon the engineering proficiency of the membership. It is stated that the Commission had only one river engineer among its members. This is not so. It is true that the one engineer referred to had given the whole of his professional life to navigation improvements on rivers and harbors and therefore may be regarded as one of the authorities in this line. It is also true that this Engineer Officer gave little of his attention to reservoir systems. Therefore, the writer doubts whether he was any more fitted to pronounce upon a plan of this character than another engineer of the Commission, who has given his whole life to the consideration of storage problems and the effect thereof in the modification of stream flow. There are diverse opinions as to the qualifications of a river engineer. The civilian engineer who differs with an Engineer Officer on a matter of river hydraulics frequently meets with accusations—courteous to be sure, but still accusations—that he is speaking from "inner consciousness," that he lacks "practical experience," etc. We know full well that the royal province of river engineering has been walled about, but we on the outside have not been idle. Real experiences have come to us, from which we have learned much. Some of us have actually been observing and thinking for ourselves and, as we have been allowed to work on non-navigable rivers, we have learned to draw conclusions. We are occasionally encouraged by chance remarks from certain members of the inner circle who have been looking at us over the wall. Some of them have become convinced that we have found a few things worth while. The dead line is not as formidable as it was. In fact, to-day many of us on the outside think we have one thing in our favor which the man on the inside is less likely to possess, because he is frequently confined "too close to his muttons." That thing is *perspective*. It was to give a perspective view to waterways that the Inland Waterways Commission was appointed. The principal reason why, in engineering, legal or medical practice, consultants are summoned is that perspective is desired. The man in immediate charge is beset with details, precedents and close-range observations. He needs and craves the advice of one who can come upon the field with an open mind and a wide visual angle.

Major Newcomer announces that navigation should not help to bear the burden of numerous other problems, such as flood protection, water pollution, etc., and that each may best be solved by more or less direct treatment adapted to its special ends. With this concept the writer must emphatically disagree. Experience in the past has established a great and fundamental fact, namely, that one and only one great problem is involved in the conservation of water resources, and when we attempt to separate the particular province of navigation from that of flood control, or the field of municipal supply from that of water power, or attempt to legislate, to contrive, or to construct for the benefit of one interest exclusively, we often find that we have wrought to the disadvantage of every other. In the construction of a building we consider that each stone laid in the wall is not merely a necessary part of the wall at [illegible] point but is a progressive feature [illegible] structure, performing its part in [illegible] the building and harmonizing it[illegible] entire plan. So should be each [illegible] development of our rivers. We h[illegible] tle, if any, permanent progress to[illegible] development of our river systems. [illegible] provements have been made here [illegible] rected toward a particular and im[illegible] pose, such as the creation of a na[illegible] nel or the storage of a municipal [illegible] yond this, conditions are chaotic. [illegible] consideration will show that the [illegible] son is that we have during past [illegible] deavored to provide specifically [illegible] terest to the exclusion of every [illegible] whole conception of river improv[illegible] been one of discrimination rather [illegible] broad comprehension, and the purp[illegible] pointing the Inland Waterways Com[illegible] to correct this. The text of the [illegible] given this Commission by the Pres[illegible] be interpreted by the thoughtful man as an aggressive protest against the feudal system of river development. It ought not to be difficult to discern the signs of the times.

Major Newcomer cites certain statements made before the Pittsburg Flood Commission, as evidence that the writer has largely surrendered his position that reservoirs occupy a place of commanding importance in any logical plan for the improvement of navigation. Major Newcomer's observations in connection therewith reveal in a peculiarly striking way that he has allowed the most important feature of the report that he criticizes to pass unrecognized. The whole report was, in effect, a plea for a broad study of the Ohio and the adoption of plans that will serve the greatest number of objects in the wisest way. The estimates showed that the proposed system of reservoirs would not provide a 9-ft. depth during all seasons on the Ohio. This was plainly stated in the original report. Therefore, it is difficult to see how a reiteration of the fact can be construed as the surrender of a position.

But the point that Major Newcomer apparently fails to appreciate is the possibility of harmonious adjustment in plans for river improvement. Because, for example, the reservoir plan fails to maintain a 9-ft. channel throughout all seasons, he is inclined to belittle the other things that it will accomplish. No one will deny that open channel is preferable to canalized conditions. It follows that if, by saving flood water, we can shorten the canalized period, the reservoirs are not without benefit even to navigation. Because the writer admits that, in case there is money available to build only one step of the final improvement at a time, it would be of more immediate utility to construct the canalization system first and proceed with the final development later, Major Newcomer considers that a position has been surrendered. The writer can take no such restricted view. He believes that certain steps are necessary to a final development of the Ohio. All these steps are but parts of a great unit problem. The step first to be taken should be determined solely by local conditions and demands. Because the writer believes a 9-ft. channel the most important immediate need, he advocated canalization before the Pittsburg Flood Commission, *in case it should be impossible to secure an immediate appropriation for the whole broad development.* It is possible that the writer would not have been so broad in his views had he been actuated by a desire to further a preconceived plan rather than to secure the highest ultimate good for all concerned.

Major Newcomer mentions certain alleged disadvantages connected with the reservoir plan, which have already been discussed in reply to the recent article of Captain William [illegible] Connor, published in Engineering News of June 11, 1908. A few more words will be added.

First, "The probable lack of available reservoir sites sufficiently distributed." This was vehemently discussed more than fifty years ago. Those who took part in the discussion at that time knew nothing about the facts and Major

*Chief Hydrographer, U. S. Geological Survey, Washington, D. C.

Newcomer gives no evidence that he has investigated much beyond the point at which our forefathers dropped the discussion. We have, as we know, numerous promising reservoir sites. From the present outlook, the conditions are exceedingly favorable. Therefore, let us investigate further and satisfy ourselves on this point. This is a fair and scientific attitude, which appears preferable to an effort to discredit the idea without more information on the subject than the original author had in his possession. It is easy to say "probable lack of reservoir sites," and it is also pertinent to inquire whether or not the framer of this sentence actually has made an investigation of the premises.

Second, "The permanent withdrawal from other uses of large areas of bottom land of exceptional fertility." Later on in this discussion Major Newcomer cites certain overflow damages which appear excessive. This is hardly in accord with the statement made by the present writer in his original report, viz.: "No sane man would advocate the construction of a reservoir in places where the cost of submergence would be excessive." In order that the reader may understand the situation it will be necessary to explain certain occurrences which serve to define the writer's attitude in this matter.

It is hoped that Major Newcomer will not object to the publication of an extract from a letter written at the time the writer was furnishing him with special data relating to the reservoir plan. In this letter, transmitting topographic sheets on which were outlined the various proposed reservoirs, the writer made the following statement:

> You will appreciate upon examination of these maps that there are many other reservoir sites in the area under consideration. It is possible that some of these might suit the purposes of conservation better than those indicated. On the other hand, it might be of advantage to increase the indicated height of some of the dams, while in other cases a more detailed examination would probably reveal the fact that some of the dams should be lowered. The point is that we have selected what may be considered a judicious working capacity for the reservoirs and have left so many reservoir sites unconsidered that there is no doubt that the maximum conservation given in the report can readily be achieved and probably very much more.

Major Newcomer probably read this letter; yet, he assails certain proposed sites as though the details were all settled. He finds fault with large overflow damages, when it is clear that a large measure of them might be avoided by adjusting the proposed height of the dams or securing equivalent capacity in other places. It is true that there will be large aggregate overflow damages in such a reservoir system, but if by such overflow there can be saved from floods a large tract of more valuable land in the lower valley, there is effected an advantageous exchange. The principle of our Government is grounded in the maxim of the greatest good to the greatest number. There is in the lower valley, a region capable of supporting by agriculture, manufacturing, transportation, etc., probably a thousand-fold more people per square mile than the less valuable country which it is proposed to overflow. Moreover, it is apparent that without such overflow in the upper country the lower country cannot reach its highest state of development and productivity. Relieved from floods, at the expense of the upper country, the Ohio River front will become one of the greatest centers of manufacturing and commerce in the world. With the agricultural lands of Ohio, Indiana and Kentucky, immediately tributary thereto, the situation will be unexampled. It is merely a further exemplification of the principle of the greatest good to the greatest number, as well as that of the survival of the fittest.

Third, "The disastrous results of possible failure of dams." This was taken up at length in the reply to Captain Connor's article. Nothing will be added except to state that it appears to be high time that the progressive engineer should so conduct his work as to place the possibility of failure beyond his fears. If the engineer of to-day, with all his experience and opportunities for observation, cannot undertake his work with confidence, it is apparent that some change should be made in our fundamental concepts. It is evident that not all the members of the United States Engineer Corps are so timorous, for some of them are enthusiastically building a dam upon which the integrity of the Isthmian Canal must rest absolutely.

Fourth, "The unsanitary conditions attending large fluctuations of water level in reservoirs." This idea is so old and discredited that the present announcement makes it seem almost new. One hundred years ago mankind grew frantic over the possibility of contracting disease from "miasmas and effluvia" arising from wet lands, swamps, and other dread conditions, but at the present time the suggestion that fluctuation of water level in reservoirs should be the cause of disease would convulse a company of sanitarians. No one is going to abide on the uncovered bottoms and it requires something more serious than odors of vegetable decay from such a place to produce an epidemic in the surrounding country. Major Newcomer should investigate the conditions in the Sudbury area of Massachusetts, where each summer the Boston reservoirs were formerly drawn down.

Fifth, "The disorganization of public road systems and obstruction of local communications." This consequence is entirely insignificant when compared with the magnitude and importance of the benefits of the reservoir system. With equal justification might one complain of the decrease in the available supply of lumber by reason of the construction of wicket dams in the Ohio. Here, the principle of the greatest good to the greatest number will apply, even as it does in the matter of flowage of reservoir sites.

Sixth, "The conflict between methods of control for flood prevention and industrial and navigation purposes." With reservoirs sufficiently large to catch the entire flood runoff, little conflict would arise that could not be adjusted. The interests of navigation and water power could be harmonized even as it is proposed by a board of United States Engineers that they shall be on the Upper Mississippi. It is true that there might be times when navigation would demand water and when water power interests would not require it, and vice versa. All this could be regulated by mutual compromise, just as our whole Governmental system is regulated. Because one interest in the United States desires a protective tariff and another desires a tariff for revenue only, no occasion arises for condemning or abolishing our form of Government. Neither need the objection here raised be fatal to the reservoir plan. If it shall prove necessary to make an occasional slight reduction in the amount of water used for power purposes, still will the ultimate benefits be far greater than the cost of the proposed improvement and immeasurably greater than under present conditions.

Seventh, "The inevitable impairment of reservoir capacity by sedimentation." We know full well that reservoirs on denuded areas, like those of the arid West, do become silted and lose capacity. But the present proposition in the Ohio Valley also involves the preservation of forests and of soil cover. This is inevitably connected with the whole scheme and necessary to it. In countries well covered with forests the figures show that silting is insignificant. In support of this, a recent letter from Mr. J. Waldo Smith, Chief Engineer of the New York Water Supply Commission, is of interest:

> The silting up of reservoirs in this part of the country goes on so slowly and gradually that but little attention has been paid to it and consequently but little is known. Any silting up which takes place over this area has no effect on the available capacity of the reservoir and so the whole question has been viewed without apprehension.
>
> The waters of this region (New York) carry a comparatively small amount of silt when compared with those of the West, and the quantity of material rolled along their beds is also very small.
>
> In my own experience I know of only one collecting reservoir on which observations as to the depth of deposit have been made. This reservoir is Kensico Lake of the New York water system. The drainage area directly tributary to it is 11.5 square miles, while into it are diverted also the water of the Byram River from 8.5 square miles and those from Rye Pond which receives the drainage of 2.5 square miles. These watersheds are quite precipitous, and geologically speaking, the surface material is fairly impervious and composed of rock dust more or less resembling clay, sand, or gravel on these drainage areas. The average rainfall in this region is about 48 ins. Kensico Lake was constructed in 1884 and has been in continuous use since that time. It has a surface area of about 250 acres and a capacity of about 1.60 billions of gallons. Rye Pond, above mentioned, has a surface area of about 300 acres and a capacity of about 1.30 billions of gallons.
>
> During the fore part of 1907 a number of soundings were made and samples taken of the silt on the bottom of Kensico Lake. The results showed that the depth of the silt ranged from 0.0 to 1.5 ft., that it averaged 0.6 ft. in depth and that it contained on an average about 13% of organic material.
>
> From these figures you will see that the capacity of this reservoir has been reduced by about 48 millions of gallons, or only 3% in twenty-three years.
>
> In the design of the Ashokan reservoir it was not considered necessary to make any allowance for diminished capacity resulting from a silting up of the basin.

Attention is especially called to the last sentence of the above letter. The greatest municipal water-supply reservoir ever constructed in the United States was planned without taking cognizance of silting, and it should be remembered that the distinguished writer of the above statement did not take this responsibility alone. He has over him in authority a commission composed of three of the foremost engineers of the world. In the construction of the proposed Ohio River reservoir system there is no reason why the silting should be very much greater than has been indicated in the above quotation, provided that suitable arrangements are made for the covering of the soil and the preservation of the forests.

But, admitting for the present, that there would be loss of capacity, can it not be conceived that this material deposited could be removed? All the reservoirs now being constructed by the United States in the arid West will undoubtedly lose capacity through silting. Does any one believe that all such contingencies have not been foreseen and provided for? Major Newcomer apparently does not see cause for alarm in the fact that the United States has in the past spent millions of dollars to dredge sediments from river channels. Why, then, should he become apprehensive over the possibility of finding it necessary to dredge the same material, only in far less quantity, from reservoirs?

Under the headings "Flood Protection" and "Pittsburg Flood of 1907," Major Newcomer has made certain suggestions, the proper discussion of which requires extended space. There are several inconsistencies and errors in the presentation which should be corrected. The writer will therefore undertake this, along with a general discussion of flood runoff, in a later communication and for the present will take up only two points that are suggested by Major Newcomer's paper.

The fact is cited that the flood of January, 1907, attained exceptional magnitude at Cincinnati, but barely passed the danger line at Pittsburg, Wheeling, and Parkersburg. Therefore, it is assumed that the upper river did not contribute largely to the flood height at Cincinnati, and consequently upper river reservoirs would not have assisted materially in reducing it. This raises the question whether or not Major Newcomer is misinformed concerning the extent of this proposed reservoir system. It would seem from the above that he is under the impression that the writer expects storage reservoirs on the Allegheny and Monongahela to prevent floods all along the Ohio. It is certain that the water which overwhelmed Cincinnati in January, 1907, must have come from somewhere, and if, as shown by the facts given, it did not come from the Allegheny and Monongahela, it must have been derived from some of the lower tributaries, like the Kanawha, Licking, Scioto, Big Sandy, and others. Examination of the records will show that such was the case. Did it not occur to Major Newcomer that these rivers might be supplied with reservoirs as well as those in his own particular district, and, if supplied, would the reservoirs not have the same effect on their particular rivers that he admits they must have under certain conditions on the Allegheny and Monongahela? It ought not to be necessary to argue that if the flood waters from the tributaries that overwhelmed Cincinnati had been held back in reservoirs, Cincinnati would not have been overwhelmed. The events taking place at Pittsburg during this particular period have no relation whatsoever to the question.

The next point under the heading "Flood Protection" is the significant and peculiar para-

graph with which Major Newcomer closes his flood discussion. He says, in effect, that, inasmuch as the banks of the Ohio have for ages been subject to overflow and the land has been occupied with full knowledge of flood menace, the question arises whether the National Treasury is properly chargeable with the cost of furnishing protection. Who has proposed that the National Treasury furnish the entire cost of the proposed reservoir system? Certainly not the writer, or, so far as he knows, any one else who is advocating internal improvements of this kind. It is believed that the great majority of thoughtful persons are in accord with Section 21 of the Preliminary Report of the Inland Waterways Commission, as follows:

> The benefits of a comprehensive system of waterway improvement will extend to all the people in the several sections and states of the country; and the means employed should be devised, so far as possible, to distribute the cost equitably, through cooperation between Federal agencies, states, municipalities, communities, corporations and individuals.

The protection of the lowlands of the Ohio from floods therefore involves a much broader concept than that indicated by Major Newcomer in the paragraph referred to; but let us confine our attention for the moment to the particular question of tax on the Federal Treasury. We may logically apply the same reasoning to navigation improvements that Major Newcomer has applied to flood protection. In fact, we may use almost the identical language. Thus we may say:

The channel **"of the Ohio has for ages been subject to"** low water. **"Occupation of the riparian lands"** for purposes of navigation **"has developed with full knowledge of this fact on the part of all concerned."** (Henry Clay made a famous statement to the effect that the Ohio River was dry one half the year and frozen the other half.) **"Property exposed to damage"** by reason of low water conditions **"has been deliberately placed there and the acceptance of this risk has doubtless in many cases been fully justified."** **"If"** transportation **"damages"** due to low water **"amount to the enormous sums stated,"** the correction of this evil **"would correspondingly increase"** the value of the property. **"The question arises whether the National Treasury is properly chargeable with the cost of"** such improvements.

What is the difference in general principle between taxing the National Treasury to improve property by removing flood menace and taxing the same Treasury for improving the same property by affording transportation? The matter is as broad as it is long. There appears to be no Constitutional limitation on the engineering methods by which interstate commerce may be facilitated. The Federal Government has constructed levees for the protection of lowlands. Why, then, could not Federal money be expended for protecting the same sort of lands with reservoirs? If Major Newcomer must complain of Federal contributions that will increase the value of private property by reason of flood protection, he must, if he would remain consistent, give similar complaint to the expenditure of Federal money that will increase the value of property by reason of enhanced navigation facilities.

Under the heading "Water Power," Major Newcomer brings up the question of how much the Federal Government would receive for additional water released from storage reservoirs and expresses doubts concerning the writer's estimates. Up to the time of reading this paragraph, the writer was not aware that he had ever made any estimates of prospective Government receipts. A careful review of the report reveals no such estimates, and if the writer has so framed any sentence that an inference of this nature, however far-fetched, may be drawn, he hereby disavows the intent. In fact, he had been under the impression that he has purposely avoided such an act. It is evident that Major Newcomer has taken the approximate value per horse-power-year, used to determine the approximate value of certain powers, as an expression of the author's opinion that the Federal Government should receive such an income. A careful reading of the report should convince him that no such assumption has been made. In each case in which the water power is discussed, the factor of $20 has been used to represent an annual rental value, and this has been expressed as representing a 3% income on a certain sum. The purpose of all this was to show, in approximate figures, the general value of water power and thereby to indicate the desirability of making it available. Just what proportion of this rental the Government should receive the writer did not attempt to determine, save that he intimated that in ordinary equity it should be a reasonable sum according to the amount expended and the benefits returned. Nor did he even assume that the Government could receive any rental, for, in the beginning of the discussion on water power, the writer stated:

> If any method can be devised by which the United States Government can realize a fair return on the additional water power created by the proposed storage system, the entire cost of the reservoirs will be returned to the treasury.

The writer did not undertake to determine to whom the conserved water belongs, for that is a problem of the statesman. For the purposes of the report, it was sufficient to show that the installation of the reservoirs would create enormous water powers, the approximate value of which could be expressed by using average factors, and the development of which will eventually be necessary if our industrial life is to develop in the future as it has in the past. It matters not whether the Federal or State Government receive the rental. This is a mere detail, insignificant in comparison with the great question. Its ultimate solution will involve merely a decision on the part of the people concerning the particular pocket out of which they wish to extract funds to pay for a certain large contribution to their general welfare.

It is easy to encumber the solution of a great problem with details, which if left alone will work themselves out. It is the writer's opinion that if in this or any other problem we pause to concern ourselves with the number of ways in which a thing cannot be done or an object cannot be accomplished we shall make very poor progress. It is more to the purpose to point out and demonstrate the possibilities of accomplishing certain objects, confident that obstacles of every kind must eventually be overcome. In this particular case, it is germaine to observe that the American people have always found a way, and when they have become convinced that the conservation of flood waters and the development of water power constitute one of the improvements by which their present development and future prosperity may be facilitated, the question of who owns the water and how the rental is going to be paid will be solved so quickly that it will hardly be an incident in the development.

Major Newcomer sets $5 per horse-power-year as a maximum rental charge for the stream flow. The Government can afford to accept such a rental with entire satisfaction, and launch into the reservoir business with the assurance that it will be a safe investment. It should be borne in mind in this connection that the value of power must constantly increase, and that, inasmuch as the proposed reservoir system is a provision for posterity as well as for the present, it is proper to take into account future values. There will come a time when $5 per horse-power-year will look as cheap as 25 cents does at the present time. Therefore, it will not do to appraise our values according to present standards.

It is suggested in reply to the statement that it is not expected to develop power at the reservoir sites on account of the extreme fluctuations in height of the water, that very valuable powers might be derived on rivers along which there are several successive reservoirs. At the lower reservoir, all or part of the ordinary flow of the river above might be brought around the reservoir by high line canal and utilized for power at the lower dam site, and this process could be used for all the reservoirs except those located highest on the several branches. Such power sites would be extremely valuable, and they would have the benefit of the regulation afforded by the reservoirs above those at which they are installed. This is the plan which has already been carried out in connection with the Salt River reservoir in Arizona. There would hardly be any question as to the ownership of such a power.

Major Newcomer occupies considerable space with a remarkable analysis of the estimate given by the writer in his original report. For the benefit of those who have not carefully examined this report, it seems desirable to repeat the facts concerning this estimate of cost.

First, there were no figures available showing the probable cost of these particular reservoirs. The Inland Waterways Commission directed that the writer submit the report at a date which allowed him less than one month of preparation. Little could be done except to set down in some semblance of order the data and deductions already in hand. No time was afforded for proper examination of the several sites for the purpose of estimating costs.

Second, it was believed wise to give such estimates of cost, however wide of the mark it might be, because if the basis of such estimate were given the intelligent reader could form his own conclusions.

Third, the only available basis of estimate was used. The actual costs of reservoirs already constructed and the computed costs of those projected were arranged in classes according to reservoir capacity. Average cost was computed for each class and the various factors were applied to the proposed basins to secure the total of about $125,000,000.

Obviously, a statement made according to the above scheme of averages is not subject to purposeful analysis. If it retains any virtue at all, that virtue must lie in the final figure, viz.: $125,000,000. Nevertheless, Major Newcomer proceeds to analyze and he finds incongruities, such as the higher mean total cost of reservoirs of one thousand to ten thousand million cubic feet capacity over those ranging from ten to twenty thousand million cubic feet. It is proper to ask Major Newcomer if he really expected any other result. His effort seems analagous to the problem of proving that two and two make four. Any one accustomed to dealing with averages and who, presumably, is familiar with the law of averages, ought to recognize at the outset that in a structure, the component parts of which are averages, derived from any divergent units, the discrepancies and incongruities must rise up in motley array. Of course, every one expects to find some small reservoirs costing more than some large ones and for this reason the departures from the components in the table given must be wide, and in some cases absurd. It is, therefore, the final result and that alone which can be taken with any degree of seriousness and even that must be handled judiciously.

It is common in discussing matters concerning which data are meagre to present figures based on certain hypotheses and give authority therefor, confident that the intelligent reader will accept as much or as little of those figures as seems warranted by his interpretation of the facts. Major Newcomer indulges in this very practice when he presents a masonry dam estimate based on $8 per cu. yd. and invites anyone who thinks a different unit should be used to modify his figures accordingly. It would be easy to fill many pages with figures and arguments to show that $8 per cu. yd. is an absurd figure. The two cases are parallel, and had Major Newcomer used the same philosophy that he expects of his readers it would not have been necessary for Captain Adams to go into the field to show that there are wide variations between the writer's averages and the probable cost of certain Monongahela reservoirs.

But Captain Adams has been to the field and has done his work thoroughly and well. His statements and conclusions merit examination. We will consider, first, some of his structural figures and then his estimate of damages and the aspect thereof.

There is a commendable effort to provide for the best structure for dams, and masonry has been chosen. Masonry is expensive and the specification thereof has served greatly to increase the total estimate given. Only one of the

dealt with by Captain Adams is less than 1,300 ft. long. [illegible] in the light of what we know of the effects of temperature changes in monolithic masonry dams, please consider the effects here. In a severe winter season, when tensile stresses will be greatest on these structures, they will usually be uncovered on both faces, i. e., the reservoirs will be empty. As a rule, our masonry dams have the advantage of a comparatively warm blanket of water on one side during the winter, which marvelously changes the whole aspect of the situation. The late Mr. George Y. Wisner went into this subject with his well known thoroughness, and brought to light many pointed facts concerning the action of masonry dams under temperature changes. He determined a tensile stress of 40 tons per sq. ft. on such a wall for every 30° in temperature below that at which the masonry was laid. The long dams in the Monongahela drainage should not be built of masonry. Repeated shocks, due to temperature changes, would injure structures, exposed as these will be, so that in a series of years progressive weaknesses would develop, which would precipitate failures and the consequent inundation concerning which Major Newcomer is so apprehensive.

The writer knows full well that the popular impression is that earth and rock-fill dams must be inferior in stability to monolithic masonry. The ocular reason for such an impression is obvious. Unquestionably, there are manifold sites in which the masonry dam is absolutely essential, but this fact does not make the universal prescription of masonry dams necessary, and especially not so in such places and under such conditions as will prevail in the Ohio basin.

The present article is no place to enter upon a full discussion of this matter and the writer will therefore be content with the suggestion that earth and rock-fill dams will in many cases be far better than masonry ones for the purposes here discussed, and he is confident that in making this suggestion he is expressing the real opinion of many eminent engineers.

There is a form of expression oft repeated in heart-to-heart conferences that take place among engineers when plans for dam construction are being discussed. It runs somewhat like this: "Personally, I would have been as well or better satisfied with an earth dam than with the masonry one that I have specified, but you know that public opinion, etc., etc."

Familiar, is it not? It is also suggestive. The world moves, ignorance and prejudice are being dispelled, and "public opinion" is always finally fixed by facts and evidence. To assume, as does Captain Adams, that the inhabitants of western Pennsylvania are always going to sustain blind prejudice against every form of dam except that of masonry is an unintentional but nevertheless an indirect reflection upon their habits of thought.

The final suggestion here to be recorded is that with reference to Captain Adams' estimate of damages and the use thereof by Major Newcomer as a measure of the probable cost of the entire Ohio system. The reader should at the outset recall the extract from the letter to Major Newcomer, quoted above, with reference to the proposed sites, viz., that, in view of the abundant storage facilities, surpassing those necessary to secure the desired results, those selected may be regarded merely as a "*judicious working capacity*," and that further examination would probably effect changes in some sites and the lowering or raising of the proposed flood line of others. For reasons not apparent, this letter seems to have been ignored. How would a fair-minded application of the principles set forth in this letter have affected the situation?

Take, for example, the proposed West Fork reservoir. As sketched in the original report, it involves the submergence of Weston, W. Va., with damages of $4,500,000. The judicious engineer, in applying the above principle, would have lowered the proposed height of the dam so that Weston would not be submerged and he would supplement the capacity here lost by providing it somewhere else in that particular basin. There are many sites for smaller reservoirs that would serve the purposes and be comparatively cheap.

Again, consider the proposed Ten-Mile Creek reservoir. There is an estimated damage of $9,600,000 for submergence of coal deposits. The judicious engineer would solve this difficulty by rejecting the site and would find additional effective capacity elsewhere. Numerous similar examples appear throughout all of Captain Adams' schedule. In other words, the writer expected that the engineers detailed to make the necessary minute examination would use discretion and good judgment, and would wisely adapt their procedure to the conditions discovered. So far as the writer can ascertain, the great majority of engineers who have examined the report have made such an inference. Therefore, a similar interpretation might have been expected from one to whom was given supplementary advice in the shape of a personal letter on this precise point.

Major Newcomer has used the estimates of Captain Adams to forecast the cost of the entire Ohio system, including therein all the enormous damages above discussed. Let us reflect a moment. In this article, Major Newcomer complains that the reservoirs used by the writer in his cost estimate are not fair criterions because their sites are far more favorable than those proposed in the Monongahela basin. This complaint is justified, but there is a saving element in the fact that the reservoirs so cited were all that were available for the purpose. After making this complaint, Major Newcomer deliberately selects as a basis of his estimate, conditions far less representative than those used by the writer, for he sent Captain Adams into the most valuable mineral region in the Ohio Valley and, with fine discrimination selected the basins in which there are workable coal deposits of great value, many manufacturing plants, and several sizeable municipalities. It was not enough to ignore the writer's statement that the reservoirs selected in the original report were not necessarily fixed in location. He must, in addition to this, select the most expensive region, from a reservoir standpoint, in the whole basin. He, perhaps, will explain why he did not select some proposed sites, of which there are many, where practically the entire damage will be confined to the submergence of farms, wild unproductive lands or timber, and thus endeavor to secure a cost factor. The facts are that in applying his cost factors to the entire Ohio basin he has placed himself in the position of assuming that beneath practically all of the reservoir sites in Ohio, Indiana, Kentucky, Tennessee, and other states covered in the plan, there are immense deposits of coal, involving in some cases a damage of nearly ten million dollars per single reservoir. He has assumed that in all these upland districts there are towns of the size of Weston and Elkins, W. Va., to be submerged and that every obscure valley comprised in the system contains manufacturing plants. Taking the whole on this basis, he forecasts the entire cost at nearly one thousand million dollars. The writer's basis of cost estimate was admittedly poor, but the defects bristled conspicuously and therefore it was fair. But, if that basis of cost estimate was poor, what is the appropriate adjective to be applied to that presented "for the sake of illustration" by Major Newcomer? If it were selected specifically for special pleading against the reservoir system it might be termed ingenious and clever; but if it were submitted as a genuine test of the probable cost of the scheme it must be denounced as specious and unfair.

It appears necessary for the writer to state once more that his opinion of the practicability of the proposed reservoir system is not based upon, nor limited by, the total given in his alleged cost estimate. This should have been apparent from an unbiased reading of the original report. If any doubts had still existed they should have been eclipsed by the writer's reply to the presentation of Capt. W. D. Connor. An estimate of $500,000,000 has recently been made by Lieut. Col. H. M. Chittenden. Until more precise information is presented the writer will still hold to his original suggestion, viz.: That the whole matter should receive thorough field study. If the proposed reservoirs will accomplish a fair proportion of all that has been prophesied in the original report, the Federal Government may proceed with its just proportion of the expenditure, confident that it never made a better financial investment.

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THE BOILER OF A LOCOMOTIVE, drawing a milk train on the New York Central & Hudson River R. R., exploded at White Plains, N. Y., Oct. 28. The engineer, brakeman and fireman, who were in the cab, were seriously injured.

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A HEAD-ON COLLISION between a freight and a passenger train on the Mexican Central Ry. a short distance south of Dañu, Mex., Oct. 25, is ascribed to disregard of orders on the part of the crew of the freight. One man was killed and four persons injured. None of the passenger coaches left the track, but the baggage car and eight of the freight cars were badly damaged.

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A COAL TRAIN STRUCK A STREET CAR of the Wilkes-Barre & Wyoming Valley Traction Co. at Dorrancetown, Pa., Oct. 30. Thirty passengers on the street car were injured. The accident occurred at the Delaware, Lackawanna & Western R. R. crossing and was due to a misunderstanding of signals.

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A WORK TRAIN on the Buffalo, Lockport & Rochester Ry., an electric line, was struck head-on by a baggage car three miles east of Lockport, N. Y., Oct. 26. Eight men were injured, two of them fatally. The baggage car is said to have overrun orders, failing to stop at the Rushford crossing.

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THE REMOVAL OF A RAIL BY WRECKERS caused the derailment of the Chicago-Duluth Limited on the Chicago & Northwestern Ry. at Kempton, Wis., Oct. 29. The engineer and about ten passengers were injured. The train was running at the rate of 45 mi. per hr. The locomotive and all but two of the cars were overturned.

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A CABLE CAR on the Washington Street line in San Francisco, Cal., became unmanageable and was derailed at the foot of a steep hill Oct. 19. Nine passengers were injured. The grip refused to work near the top of the hill and it was found impossible to stop the car with the brakes.

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A TROLLEY CAR COLLISION in Cleveland, Ohio, Oct. 30, resulted in injury to 80 passengers, five of whom were seriously hurt. The accident occurred at the Superior Avenue Viaduct, which is fitted with a drawbridge over the Cuyahoga River. The draw was open and one car had stopped within about 40 ft. of the edge. A second car crashed into the rear of the first, the brakes of which were fortunately tightly set, otherwise a worse disaster might have occurred.

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A FERRYBOAT ON THE POTOMAC RIVER was struck by a steamer opposite the Firth-Sterling Steel Co.'s plant at Giesboro, D. C. One passenger was killed and three were injured in the collision which occurred during a fog. The wrecked ferryboat was the "Lackawanna" of the Washington & Alexandria line. The steamer, the "Washington" of the Norfolk & Washington line, was only slightly damaged, but a large portion of the starboard side of the ferryboat was torn away and she was beached near the mouth of Four Mile Run to save her from sinking.

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A $5,000,000 CONTRACT for electrical apparatus for the motive equipment of the New York terminal of the Pennsylvania R. R. was reported on Nov. 3 as awarded to the Westinghouse Electric & Manufacturing Co., of Pittsburg. Other heavy contracts are expected to follow this one.

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PANAMA CANAL EXCAVATION during October totaled 3,282,276 cu. yds., a daily average of 121,565 cu. yds. for 27 working days, as against 3,158,886 cu. yds. for September, a daily average of 126,355 cu. yds. for 25 working days. The record for the past two months is as follows:

| | October. | September. |
|---|---|---|
| Steam Shovels: | | |
| Atlantic division | 155,142 | 136,892 |
| Central division | 1,551,409 | 1,442,567 |
| Pacific division | 135,876 | 135,530 |
| Dredging: | | |
| Atlantic division | 505,290 | 624,776 |
| Pacific division | 765,876 | 750,080 |
| Canal prism total | 3,113,563 | 3,089,851 |
| Accessory works outside canal prism: | | |
| By steam shovel | 111,075 | 68,451 |
| By hand | ..... | 584 |
| By dredging | 57,638 | ..... |
| Total excavation | 3,282,276 | 3,158,886 |

The rainfall during October was 10.51 ins. against 9.72 ins. in September.

A REMARKABLE OIL WELL in the Atlantic coastal plain of Mexico is said to have caused the deaths of many men by the emission of poisonous gases recently. The well is known as Dos Bocas. Oil was struck in the well on July 4th last, and the escape of oil and gas at once assumed the force of a miniature volcano. The escaping oil caught fire at once and the conflagration raged for months with such intensity that no one could approach the spot. This continued until about Sept. 1 when the walls of the well caved in and cut off temporarily the flow of gas and oil and extinguished the flames. The flow was reestablished, however, and for months a vast volume of boiling water, oil and gas have been poured forth. A local correspondent informs us that the crater is now about 750 ft. in diameter and the engineer of the oil company estimates that about a million barrels of water and forty thousand barrels of oil are thrown out daily. The surrounding country and the water courses for a great distance are covered with oil and the yellowish water from the well.

The well is located about 75 miles southeast of Tampico near the navigable lake Tamiahua. Recently the well has been emitting poisonous gases, and newspaper reports place the total loss of life as high as 50. It is also stated that a coast steamer which arrived at New Orleans recently passed through a great volume of smoke and gas from the well which had drifted to seaward and the white paint on the vessel was turned dark by the action of the gas.

THE FORMOSA TRUNK RAILWAY was completed by Japan and opened to traffic on Oct. 25. Its total length is 334 miles, of which about one-fifth had been built under the Chinese regime. Considerable branch-line construction is expected.

A PROCESS OF REDUCING IRON ORES without the use of a blast furnace and without fusion, has been invented by Mr. J. T. Jones of Iron Mountain, Mich. It is said to be more economical and effective than the common method, particularly in the treatment of the lower grade ores. The furnace consists of a cylinder 8 ft. in diameter and 120 ft. long which is mounted on bearing wheels at a slight slope. The ore is fed in at the higher end and, as the cylinder revolves, moves slowly toward the lower end. At the lower end is introduced a powerfully reducing flame which is fed with gas from a specially designed producer. The flame is so adjusted as to give a temperature of 1,470° F. at the lower end and it is claimed that this gives a complete reduction of all oxides. The hot gases pass up through the ore and emerge at the upper end of the cylinder at a temperature of 400° F. as $CO_2$. The fuel required per ton of iron produced by the Jones process is given as 625 lbs., against 2,000 lbs. of coke in the blast furnace. A description of this process was published in "Mining Science" for Oct. 8, 1908.

IDLE FREIGHT CARS continue to decrease. The latest report of the American Railway Association's committee on Car Efficiency, giving figures for Oct. 14, 1908, shows a total car surplus of 115,036 (as compared with 133,792 on Sept. 30), a decrease of 18,756 in two weeks (as against a decrease of 39,895 in the preceding two weeks). The largest part of the 18,000 decrease was in coal, gondola and hopper cars. Notable shortages are reported from some sections, the Northwest and Canada particularly; the total of shortage is 13,199 cars, an increase of 5,000 in the two weeks since Sept. 30. The shortages are mostly under the heading box cars.

Together with the decrease in idle road cars must be reckoned a continuing decrease in "bad order" or "shop" cars, which during the period of idleness jumped to twice the usual percentage. The report quoted says in general terms that there is "considerable further decrease in the number of bad order cars," but gives no figures. Presumably the number of shop cars is still above normal, so that the actual car surplus is larger than the figures show.

A TEST OF IRON SLAG PAVING BLOCK has been made in Montreal, Que., comparing it with the shale block in common use. Five "Metropolitan" blocks were first tested in a rattling machine according to the standard set down by the United States Government in the bulletin of 1903 on the testing of road materials. These blocks weighed originally exactly 10 lbs. each. At the end of 600 revolutions, their weight was reduced to 46½ lbs., showing a loss by abrasion of 7%. After a total of 1,800 revolutions, the five blocks weighed 41⅛ lbs., giving a total loss of 17¾% of the original weight. Five "Scoria" blocks weighing from 11¾ to 13½ lbs. with a total weight of 63 lbs. were next tested. The "Scoria" block is an iron slag block made in England. After 600 revolutions their combined weight was reduced 7¼% by abrasion, and after 1,800 revolutions the loss was 40.4% of the original weight; more than twice as great as that for the "Metropolitan" block. The speed of the rattler was 35 r. p. m. Two of the five slag blocks broke during the test, and it is due to this that the per cent. loss was so high after 1,800 revolutions for these blocks, as the broken blocks were treated as a total loss. None of the shale blocks were broken. These tests were made by the Milton Hersey Co., Ltd., 171 St. James St., Montreal.

It should be noticed that the results of this test do not afford an altogether fair basis of comparison for loss by abrasion in the two kinds of block, on account of the element of uncertainty introduced by the breaking, "due to defective structure and weakness" of two of the iron slag blocks. The two lightest slag blocks weighed together 23¾ lbs. Assuming that it was these two that broke, we have 39¼ lbs. as the original weight of the remaining three (the only ones weighed at the conclusion of the test). The final weight was given as 35 lbs., which shows a loss by abrasion—ignoring the broken blocks—of only 10.8% as compared with 17.75% for the shale blocks. But this is not conclusive for the two slag blocks eliminated may very probably have been much softer than the remaining three.

THE EXTENT OF FIRE DAMAGE in the Adirondacks is exceedingly great, according to a report to the Public Service Commission of New York State by Commissioner T. M. Osborne, who made a reconnaissance trip through the forest-fire district of the State with a view to determining approximately the part played by railways in causing the forest fires. He expresses the belief that the damage is fully as great at that of 1903, particularly because the dry condition of the ground this year involved the forest floor in the conflagration over large areas of country. He says "it is undeniable that a vast territory has been seriously and a great deal of it irretrievably damaged. . . . There are now large tracts burned down to the bare rock; not only the forests, but the foundation of the forests is gone. That can probably never be replaced." He expresses the specific conclusion that this year's fires were the most disastrous ever known in New York, except perhaps those of 1903, that many of the fires started along railway tracks and were undoubtedly caused by engine sparks, and that to protect the forests the railways must take more efficient measures than are now in use.

SOME DIFFICULTIES IN THE RICKEN TUNNEL have been reported recently. This tunnel, between Uznach and Wattwyl in northeastern Switzerland, is completed except for a small length of masonry lining. The advance of the headings was interrupted a year or two ago, as reported in these pages, by strong flows of combustible gas. It seems that there is still a slight flow of gas, for which 4-in. vent-tubes were built in the lining masonry, and that the gas has become ignited and, the flame striking back through the vent-tubes, is now burning behind the lining. No damage has yet been caused by this, and it is expected that the gas flow will soon be exhausted. At another point in the tunnel, where soft rock was encountered, the edges of the arch blocks began to spall recently, and the abutments have crowded together, as much as 12 ins. in places. The movement is not continuing, it seems, and no trouble is anticipated in rebuilding the unstable section, a length of about 200 ft. The above data are reported by the "Schweizerische Bauzeitung" of Oct. 3 from a personal inspection.

## PERSONALS.

Mr. Albert E. Smith has been elected City Engineer of Warren, O., succeeding Mr. E. M. Milligan, resigned.

Mr. J. K. Witman has been appointed Superintendent of Materials and Supplies of the Philadelphia & Reading Ry., succeeding John H. Rankin, deceased.

Mr. J. T. Connor, Master Mechanic of the Houston & Texas Central R. R. at Ennis, Tex., has been appointed Superintendent of Motive Power and Machinery in place of Samuel Millican, deceased.

Mr. J. M. Lee, Vice-President of the Percival Wood Preserving Co., has been appointed Commission Engineer of the State of Oklahoma. He is to make a revaluation of all the railways in that State.

Mr. William McElroy, City Engineer of Fort Scott, Kan., has resigned in order to take up a course of study at the Rolla School of Mines at Rolla, Mo. His resignation is to take effect Dec. 1.

Mr. Frank Ward has been elected Borough Engineer at Ridgeway, Pa. Previous to Mr. Ward's election, it had been the practice at Ridgeway temporarily to engage an engineer whenever one was required.

Mr. Edwin H. Rogers, M. Am. Soc. C. E., has resigned the position of Chief Engineer of the Boston & Worcester Street Ry. Co. to become City Engineer of Newton, Mass., with headquarters at City Hall, West Newton, Mass.

Mr. J. A. Kinkead, Assoc. Am. Soc. M. E., has resigned as Engineer of Tests, American Locomotive Co., and has become Manager of Sales for the Parkersburg Iron Co., Parkersburg, Pa., in New York, New England and Canada. His office is at 2601 Singer Bldg., New York.

Mr. J. C. Bertsch, M. Am. Soc. M. E., has resigned his position as General Superintendent of the Central City Ice Co. of Macon, Ga. His resign[ation] took effect Oct. 1. In connection with the practice o[f] profession as a Refrigerating Engineer and Archit[ect] Mr. Bertsch is now conducting a patent bureau. H[is] 228 and 230 Brown-Randolph Bldg., At[lanta] Ga.

Mr. John F. Hayford, M. Am. Soc. C[. E.] has been appointed Dean of the Engineering S[chool] of North-western University and will take up his [duties] position Sept. 1, 1909. Mr. Hayford gra[duated] in that nell in 1889, and was an Instructor in C[ivil] Engineering at that University from 1895-98. Sin[ce] then he has been connected with the U. S. Coast and [Geodetic Sur-] vey. He is the author of a book on "G[eo]-omy."

### Obituary.

James Harper, for 20 years County Engi[neer] of Beaver Co., Pa., died Oct. 18 at his home in B[eaver], Pa. His death was due to heart failure. Mr. H[arper] was 81 years old.

Alfred A. Raymond, inventor of the Ray[mond] concrete pile and Vice-President of the Raymond Concrete Pile Co., died recently at Regina, Canada. Mr. Raymond was born at Lockport, N. Y., in 1848.

Charles Hartshorne, who was Vice-Pr[esident] of the Lehigh Valley R. R. from 1868 to 1899, died Oct. 30 at his home at Merion Station, Pa. Mr. Hartshorne was born in Philadelphia, Pa., in 1829 and graduated at the University of Pennsylvania in 1847. He was a trustee of Lehigh University and of Bryn Mawr College.

Allan L. McDermott, formerly President of the Washington Ry. & Electric Co., of Washington, D. C., died Oct. 26 at his home on Crescent Ave., in Jersey City, N. J. Mr. McDermott was born in Boston, Mass., in 1854 and was a graduate of the New York Law School. He has held many state, county and municipal offices in New Jersey.

## ENGINEERING SOCIETIES.

COMING MEETINGS.

ROADMASTERS AND MAINTENANCE-OF-WAY ASSOCIATION OF AMERICA.
Nov. 10-12. Annual meeting at Milwaukee, Wis. Secy., W. E. Emery, West Chicago, Ill.

AMERICAN RAILWAY ASSOCIATION.
Nov. 18. Annual meeting at Chicago, Ill. Secy., W. F. Allen, 24 Park Pl., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 19-20. Annual meeting at New York City. Secy., W. J. Baxter, 29 West 39th St., New York City.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Nov. 30-Dec. 1. Annual meeting at New York City. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 15-17. Annual convention at Washington, D. C. Secy., Glenn Brown, "The Octagon," Washington, D. C.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—At the meeting of the Mechanical Section, Oct. 29, a paper on "The Works of the Canadian Locomotive Co., Kingston," by Mr. Henry Goldmark, was read. A meeting of the Mining Section will be held at Montreal, Nov. 12.

NATIONAL ASSOCIATION OF CEMENT USERS.—At the fifth annual convention to be held at Cleveland, O., Jan. 11-16, an exhibition of cement products and appliances will be held at the Central Armory. Applications to be considered in the first allotment of space must be received at the office of the association, Harrison Bldg., Philadelphia, by noon, Nov. 16.

AMERICAN MINING CONGRESS.—The eleventh annual session will be held at Pittsburg, Pa., Dec. 2-5. Delegates are appointed by the President and the chief executives of foreign nations, by state, county and municipal officers in the United States and by scientific and engineering societies and state mining schools. A meeting of the members will be held at Pittsburg, Dec. 3, to elect three Directors to succeed E. A. Colburn, Alexander Dempster and L. W. Powell, whose terms of office expire.

NEW ENGLAND WATER-WORKS ASSOCIATION.—The November meeting will be held at Hotel Brunswick, Copley Square, Boston, on Nov. 11. The following papers will be presented: "Private Fire Protection and Insurance Rules," Gorham Dana, Manager Underwriters' Bureau of New England; "Public Water Supplies of the State of New York," H. D. Pease, Director State Hygienic Laboratory, Albany, N. Y. The committee appointed to nominate officers for the ensuing year report the following list: For President, Robert J. Thomas; for Vice-Presidents, George A. King, William F. Sullivan, George A. Stacy, Allan Hazen, William C. Hawley, Ermon M. Peck; for additional members of Executive Committee, George W. Batchelder, Frank L. Fuller, Edmund W. Kent; for Secretary, Willard Kent; for Treasurer, Lewis M. Bancroft; for Editor, Richard K. Hale; for Advertising Agent, Charles W. Sherman; for Finance Committee, George Cassell, John C. Chase, Hugh McLean.

# CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, November 5, 1908.


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## CONSTRUCTION NEWS.

### PLANS AND SPECIFICATIONS ON FILE.

(* *denotes that this work is advertised in Engineering News.*)

The following plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

| Bids close. | Work. | Place. | See issue. |
|---|---|---|---|
| 11-13 | Alley impvt., | St. Louis, Mo. (S.) | 10-29 |
| 11-14 | Coal-handling plant, | Charleston, S. C. (S.) | 10-15 |
| 11-14 | Dredging, | Galveston, Tex. (S.) | 10-15 |
| 11-16* | Sewers, | Hartwell, Ohio. (S.) | 10-22 |
| 11-17* | Lock and dam, | Mobile, Ala. (P. & S.) | 9-17 |
| 11-20* | Bridge, | Beaufort, N. C. (P. & S.) | 10-29 |
| 11-20* | Dredge, | Mobile, Ala. (P. & S.) | 10-15 |
| 11-21 | Freight elevators, | Charleston, S. C. (S.) | 11- 5 |
| 11-21 | Air compressors, | Wash., D. C. (S.) | 11-5 |
| 11-21 | Alterations of bldgs., | Philadelphia, Pa. (S.) | 10-22 |
| 11-21 | Water mains, | Pensacola, Fla. (S.) | 10-29 |
| 11-28* | Railway, dry-dock, | St. Louis, Mo. (P. & S.) | 11-29 |
| 11-30 | Aqueduct, | Los Angeles, Cal. (S.) | 10-22 |
| 12- 1 | Dredging, | Hawaii (S.) | 9-17 |

### LIST OF CONTRACTS PENDING.

#### LIGHT, HEAT AND POWER PLANTS.

11-10 Elec. light plant, St. Marys, Kan. 10-29
11-10 Wiring, Madison, Wis. ..... 11- 5
11-18 Transformer station, etc., Plattsburg, N. Y. ..... 10-29
11-21 Alterations, 'phone system, etc., Philadelphia, Pa. ..... 10-29
11-23 Sale, gas plant, Newburn, N. C. 10-29

#### BRIDGES.

11- 6 Bridge, Tipton, Ind. ..... 10-29
11- 7 Bridges, Frankfort, Ind. ..... 10- 8
11- 9 Bridges, Los Angeles, Cal. ..... 11- 5
11- 9 Bridge lumber, Grundy Center, Iowa ..... 11- 5
11-10 Bridge, Visalia, Cal. ..... 11- 5
11-10 Superstructure, Chicago, Ill. ..... 11- 5
11-10 Substructure, etc., Fremont, Neb. 10-29
11-11* Bridge work, Chicago, Ill. ..... 10-29
11-11 Bridge, etc., Cleveland, Ohio. ..... 10-22
11-11 Bridge, Toledo, Ohio ..... 10-22
11-11 Bridge, Whitefish Point, Mich. ..... 11- 5
11-11 Bridge, Takoma Park, D. C. ..... 11- 5
11-12 Bridge, Charles City, Iowa. ..... 10-15
11-13 Bridge, Madisonville, Ohio. ..... 10-29
11-18 Bridge, Marianna, Ark. ..... 10-22
11-20* Bridge, Beaufort, N. C. ..... 10-29
11-25 Bridge, Hanover, Va. ..... 11- 5
12- 7 Bridge, Grenada, Miss. ..... 10-29
1-12 Bridge, Rensselaer, Ind. ..... 10-29

#### BUILDINGS.

11- 6 Schools, Philadelphia, Pa. ..... 11- 5
11- 7 Post-office, Eugene, Ore. ..... 10- 8
11- 9 Tower, St. Paul, Minn. ..... 10- 8
11- 9 Steam heating, etc., Washburn, N. Dak. ..... 10-22
11- 9 Stable, tunnel, New York ..... 10-29
11- 9 Fire house, Hartford, Conn. ..... 11- 5
11-10 Remodeling, Philadelphia, Pa. ..... 11- 5
11-10 Post-office, Toledo, Ohio. ..... 10-22
11-10 Armory, White Plains, N. Y. ..... 10-22
11-10 Court-house, Schenectady, N. Y. ..... 10-15
11-10 High school, Fremont, Ohio. ..... 10-29
11-11 Extension of Court-house, Newbern, N. C. ..... 10-22
11-11 School, Chicago, Ill. ..... 11- 5
11-12 Steam and disinfecting plant, New York, N. Y. ..... 11- 5
11-13 Removing pavilions, New York. ..... 11- 5
11-14 Quarters, Ft. Worden, Wash. ..... 11- 5
11-16 Heating, etc., Youngstown, O. ..... 11- 5
11-16 Post-office, Iola, Kan. ..... 10-22
11-16 Schools, New York ..... 11- 5
11-17* Hospital, Weehawken, N. J. ..... 10-15
11-17 Post-office, Crookston, Minn. ..... 10-29
11-18 Plumbing, etc., Ft. Hancock, N.J. 10-29
11-18* Post-office, New Ulm, Minn. ..... 10-15
11-19 Post-office, Rawlins, Wyo. ..... 11- 5
11-20 Post-office, Trinidad, Colo. ..... 10-29
11-21 Bldg. alterations, Phila., Pa. ..... 10-22
11-23 Infirmary, Chicago, Ill ..... 11- 5
11-25 Post-office, Hazelton, Pa ..... 11- 5
11-25 Warehouse, Cincinnati, O ..... 11- 5
11-30 Post-office, Milford Del. ..... 10-29
11-30 Post-office, Manchester, Va. ..... 11- 5
12- 1 Post-office, Newton, Kan. ..... 10-29
12- 7* Post-office, Carlisle, Pa. ..... 10-29

#### WATER-WORKS.

11- 7 Water main, Fort Slocum, N. Y. 10-22
11- 9* Settling basin, Kansas City, Mo. 10-22
11- 9* Water-works, Las Animas, Colo. 10-29
11-10 Water-works, St. Marys, Kan. ..... 10-22
11-10 Water mains, etc., Clarksdale, Miss. ..... 10-29
11-10 Water pipe, Detroit, Mich. ..... 11- 5
11-11 Pumping station, Baltimore, Md. 11- 5
11-12 Reservoir, San Diego, Cal. ..... 11- 5
11-12 Water main, Fargo, N. Dak. ..... 11- 5
11-12 Tank, Fort Dodge, Iowa. ..... 11- 5
11-12* Water-works, Gadsen, Ala. ..... 10-22
11-12 Pumping station, Toledo, Ohio. ..... 10-22
11-17* Engines, pumps, Warren, Pa. ..... 10-29
11-17* Borings, New York. ..... 10-29
11-18 Pumps, etc., San Francisco, Cal. 11- 5
11-20 Boiler, Fort McIntosh, Tex. ..... 10-29
11-21 Water mains, Pensacola, Fla. ..... 10-29
11-23* Filtration plant, Wilmington, Del. 10-15
11-23* Equipment, Pittsburg, Pa. ..... 11- 5
11-24 Boilers, etc., Pekin, Ill. ..... 11- 5
11-24* Reservoir, engine, Meridian, Miss. 11- 5
11-24* Pumping engine, Augusta, Ga. ..... 11- 5
11-24* W.-wks. extensions, Wenatchee, Wash. ..... 10-29

#### SEWERS.

11- 6 Sewer, Spencer, Iowa. ..... 10-29
11- 6 Sewer, Salt Lake City, Utah ..... 11- 5
11- 6 Sewer, Altoona, Pa. ..... 11- 5
11- 7 Sewer, Burlington, Iowa ..... 11- 5
11- 7 Sewer, San Diego, Cal. ..... 10-29
11- 9 Sewers, New York, N. Y. ..... 10-29
11- 9 Sewer, Lockland, Ohio ..... 11- 5
11- 9 Sewers, Zanesville, Ohio ..... 11- 5
11-10 Sewer, South Bend, Ind. ..... 11- 5
11-10 Sewers, Clarksdale, Miss. ..... 10-29
11-11 Tile drains, etc., Northwood, Ia. 10-29
11-12 Sewers, Fargo, N. Dak ..... 11- 5
11-12 Sewers, Marshall, Ill. ..... 11- 5
11-12 Sewer, Cleveland, Ohio ..... 11- 5
11-16 Sewers, Fort Dodge, Iowa ..... 11- 5
11-16* Sewers, Washington, D. C. ..... 10-29
11-16* Sewers, Hartwell, Ohio. ..... 10-15

#### STREETS AND ROADS.

11- 6 Sidewalks, St. Louis, Mo. ..... 10-29
11- 6 Road impvt., Cincinnati, Ohio. ..... 10-29
11- 6 Road, Indianapolis, Ind. ..... 10-22
11- 6 Roads, Lafayette, Ind. ..... 10-22
11- 6 Grading, etc., Scottdale, Pa. ..... 10-29
11- 7 Macadam, Hartford, Conn. ..... 11- 5
11- 7 Macadam, Salem, N. H. ..... 11- 5
11- 7 Road, Kansas City, Kan. ..... 10-15
11- 7 Road, Crawfordsville, Ind. ..... 10-15
11- 9* Roads, Albany, N. Y. ..... 10-15
11- 9 Sidewalks, Ashland, Ohio ..... 10-22
11- 9 Paving, New York, N. Y. ..... 10-29
11- 9* Pavements, Ashland, Ky. ..... 10-29
11- 9 Macadam, Crosswicks, N. J. ..... 10-29
11- 9 Regrading, etc., Texas City, Tex. 11- 5
11-10 Curb and gutter, etc., Vinita, Okla. ..... 11- 5
11-10 Grading, etc., South Bend, Ind. 10-29
11-10 Regulating, etc., New Brighton, N. Y. ..... 10-29
11-11* Roads, Albany, N. Y. ..... 10-15
11-11 Regulating, etc., Brooklyn, N. Y. 11- 5
11-12 Paving, etc., New York ..... 11- 5
11-13* Roads, Albany, N. Y. ..... 10-15
11-13 Paving, etc., St. Louis, Mo. ..... 10-29
11-14 Street cleaning, Evansville, Ind. 11- 5
11-14 Roads, Covington, Ind. ..... 10-29
11-14 Road impvt., Cleveland, O. ..... 11- 5
11-16 Road work, North Yakima, Wash. 11- 5
11-18 Sidewalks, Opelousas, La. ..... 11- 5
11-18 Paving, etc., Brooklyn, N. Y. ..... 11- 5
11-20 Street impvts., Indianapolis, Ind. 10-22
11-20 Road, Wabash, Ind. ..... 10-29

#### MISCELLANEOUS.

11- 6 Ditch, Peru, Ind. ..... 11- 5
11- 6 Docks, Troy, N. Y. ..... 11- 5
11- 6 Breakwater, Blue Rocks, N. S. ..... 10-29
11- 6 Breakwater, wharf, Ottawa, Ont. 11- 5
11- 7 Sale of tug, Boston, Mass. ..... 10-29
11- 7 Wharf, Ft. De Soto, Fla. ..... 10-29
11- 7 Metal lockers, Wash., D. C. ..... 10-22
11- 7 Ditch, Marion, Ind. ..... 11- 5
11- 9 Drain, Clarion, Iowa ..... 11- 5
11- 9 Battleships, Washington, D. C. ..... 9-17
11- 9 Ry. material, Panama. ..... 10-29
11- 9 Ditch, Eldora, Iowa. ..... 10-29
11-10 Machinery, Tompkinsville, N. Y. 10-29
11-10 Levees, etc., Velasco, Tex. ..... 10-29
11-10 Breakwater, wharf, Ottawa, Ont. 11- 5
11-10 Retaining wall, New York ..... 10-15
11-10 Buoys, etc., Tompkinsville, N. Y. 11- 5
11-11 Ditch, Estherville, Iowa ..... 10-22
11-11 Marble column shafts, Washington, D. C. ..... 10-29
11-11 Ditch, Northwood, Iowa ..... 10-29
11-12 Enameled brick, Atlanta, Ga. ..... 10-29
11-12 Wharves, St. John, N. B. ..... 10-29
11-13 Breakwater, wharf, Ottawa, Ont. 11- 5
11-13 Wharf, Cap St. Ignace, Que. ..... 10-29
11-14 Coal-handling plant, Charleston, S. C. ..... 10-15
11-14 Dredging, Galveston, Tex. ..... 10-15
11-14 Drain, Burlington, Iowa. ..... 11- 5
11-14 Ditch, Corning, Iowa ..... 11- 5
11-14 Ditch, Walsenburg, Colo. ..... 11- 5
11-14 Drainage, Barstow, Tex. ..... 11- 5
11-16 Fire-hose, New York. ..... 11- 5
11-16 Alarm boxes, New York. ..... 11- 5
11-16* Cranes, Panama ..... 10-22
11-16 Wharf, Algoma, Ont. ..... 10-29
11-16 Old material, Jeffersonville, Ind. 10-29
11-16 Breakwater, wharf, Ottawa, Ont. 11- 5
11-16 Garbage reduction, Columbus, O. 11- 5
11-17 Ditches, Paragould, Ark. ..... 11- 5
11-17 Trent Canal, Ottawa, Ont. ..... 10-29
11-17* Barge canal, Albany, N. Y. ..... 10-22
11-17* Lock and dam Mobile, Ala. ..... 9-17
11-18* Coal tower, San Francisco, Cal. 10- 8
11-18* Barge canal, Albany, N. Y. ..... 10-22
11-19 Seawall, San Francisco, Cal. ..... 11- 5
11-19 Breakwater, wharf, Ottawa, Ont. 11- 5
11-19 Pier, San Francisco, Cal. ..... 10-29
11-20* Dredge, Mobile, Ala. ..... 10-15
11-20 Embankments, Cincinnati, Ohio. 11- 5
11-21 Dock superstructure, Erie, Pa. ..... 11- 5
11-21 Freight elevators, Charleston, S. C. ..... 11- 5
11-21 Air compressors, Washington, D. C. ..... 11- 5
11-21 Vacuum cleaning, Cleveland, O. ..... 11- 5
11-23 Breakwater, wharf, Ottawa, Ont. 11- 5
11-27 Breakwater, wharf, Ottawa, Ont. 11- 5
11-28* Ry. dry-dock, St. Louis, Mo. ..... 10-29
12- 1 Dredging, Hawaii ..... 9-17
12- 4* Gymnastic apparatus, Prescott, Ariz. ..... 11- 5
12-15 Steam collier, Washington, D. C. 10-29

#### FOREIGN.

11-26 Mines, Turkey ..... 10- 8
12- 1* Sewers, paving, Ecuador ..... 8- 6

#### CIVIL SERVICE.

11- 6 Clerk, New York ..... 10- 8
11- 9 Elec. Engr., Wash., D. C. ..... 10-15
11- 9 Lab. Chief; Wash., D. C. ..... 10-15
11- 9 Agricultural Asst., Wash., D. C. 10-15
11-11 Lab. Aid, Wash., D. C. ..... 10-15
11-16 Assistant, Wash., D. C. ..... 10-22
11-17 Scientific Asst., Wash., D. C. ..... 10-22
11-17 Examiners, etc., Wash., D. C. ..... 10-15
11-17 Insp. Supplies, San Francisco, Cal. ..... 10-15
11-19 Assistant, Washington, D. C. ..... 10-22
11-23 Elec. Engr.—Draftsman—Washington, D. C. ..... 10-22
11-24 Editor, Wash., D. C. ..... 11- 5
11-25 Office Engr., Wash., D. C. ..... 10-22
11-25 Laboratory Asst., Wash., D. C. 11- 5
12- 2 Junior Chemist, Wash., D. C. ..... 11- 5
12- 2 Junior Engr., Wash., D. C. ..... 11- 5

### RAILWAYS.

CANADA.—It is announced that a company is being formed with $1,000,000 capital to build a line in the Cobalt district, Ontario. The proposed route is from Lake Temiskaming to Upper Satika Lake, about 28 miles. The line is to be built to carry silver ore from the mines. W. H. Rowley, J. N. Fortin, G. H. Millem, J. Caron, J. E. Gravelle and D. Caron, of Hull, Que., are said to be interested.

CANADIAN WESTERN.—Hough, Campbell & Ferguson, of Winnipeg, Man., are the solicitors for this company, which has made application for incorporation to the Dominion Parliament. The company plans to build a line from a point on the International boundary in Alberta, north to the Crow's Nest Pass line of the Canadian Pacific, between Cowley and Pincher Creek, thence northwest following the valley of the north fork of Old Man River to the Livingston range of mountains; thence through a pass at that point, northerly by the valley of the Livingstone River to High River, and then northeasterly to Calgary; also from a point on the main line near its junction with the Livingstone River to the Rocky Mountains west of Goulds Dome, and through a pass in the mountains to the valley of the Elk River, following the valley of that river southerly to a junction with the Canadian Pacific and the Great Northern near Michel.

CAZENOVIA & SAUK CITY.—We are officially informed that this company, recently incorporated in Wisconsin, has postponed date for letting contracts for a few months. Company will build from Lavelle to Cazenovia and to Sauk City, 42 miles, connecting with the Chicago, Milwaukee & St. Paul Ry. at Sauk City. Capital, $30,000. Survey is partly made. Right-of-way and capital has been obtained for first six miles. J. E. Hanzlik is Secy., Cazenovia. Engineer has not been appointed yet. Previously noted.

CENTRAL OF GEORGIA.—Regarding the statement in the issue of Oct. 8 that this company is surveying between Cedartown, Ga., and Sprite, to shorten the distance between Atlanta and Chattanooga, about 40 miles, we are officially advised by C. K. Lawrence, Ch. Engr., Savannah, Ga., that nothing will be done as only preliminary lines were run for information.

CHICAGO, ROCK ISLAND & PACIFIC. — The Rock Island system has awarded the DALHOFF CONSTRUCTON CO., Little Rock, Ark., contract for the construction of new terminal yards at Huriburt; near Hopefield, Ark., which is sometimes known as West Memphis, according to the Boston "Transcript." The estimated cost is $200,000. The contract for the construction of terminal tracks, roundhouse and coal chutes.

DAKOTA SOUTHERN. — Incorporated in South Dakota, with headquarters at Lemmon, S. Dak., and Dickinson, N. Dak. Capital, $90,000,000. The company proposes to build a line from Rapid City, S. Dak., northeast to Lemmon, S. Dak., thence northwest to Williston, N. Dak., about 500 miles. The incorporators include: C. F. Merry, John Reisbach, of Dickinson, N. Dak.; J. C. Johns, of Hettinger, N. Dak.; G. L. Lemmon and E. C. Delehan, of Lemmon, S. Dak.; L. E. Gaffy and B. Morse, of Pierre, S. Dak.

DALLAS & NEW MEXICO.—See Gulf, Texas & Western Ry.

GULF, TEXAS & WESTERN.—This company has filed application for a charter. It will succeed the Dallas & New Mexico Railway, lately sold to Megargel & Co., 5 Nassau St., New York, N. Y. The proposed line will run from a point in Sabine County to Benjamin, in Knox County, 500 miles, via Tyler, Kaufman and Dallas. A branch from Booneville to Fort Worth is contemplated. The incorporators are R. C. Megargel, of New York; J. J. Jeermyn and R. B. Williams, of Scranton, Pa.; Ben B. Cain, Tyler, Tex.; L. M. Dabney, Bennett Hill, and J. W. Pinson, of Dallas, Tex.; J. W. Cain, of Chicago; and Oliver Loving of Jacksboro, Tex. Capital, $500,000.

MONTANA, WYOMING & SOUTHERN.—The city of Sheridan, Wyo., has subscribed $10,000 toward this new railway. As noted last week, this company has been granted a charter in Wyoming, with $5,000,000 capital, to build from Sheridan, Wyo., north to Miles City, Mont., 125 miles. An extension may eventually be built from the proposed southern terminus at Sheridan, south to the Colorado & Southern at Orin Junction, Wyo., 180 miles. R. H. Walsh, Pres. of the First National Bank, Sheridan, is Pres.

NORFOLK & SOUTHERN.—The receivers for this road, in a report filed with the Federal Court in Norfolk, Va., make various recommendations for betterments, including: the completion of the bridge across Albemarle Sound at an additional cost of $380,000, $221,000 having already been expended, when construction work was stopped on account of lack of funds; conversion of three of the present wooden bridges to steel structures at a cost of $17,500; expenditure of $119,000 for ditching, banking and general improvement, and the expenditure of $65,000 for rearrangement and enlargement of shops, including those at New Bern, N. C. Percy S. Stephenson is Special Master. Thomas Fitzgerald is Receiver and Gen. Mgr., Norfolk.

OREGON MIDLAND.—Incorporated in Oregon with $100,000 capital to build from Weiser, Idaho, northwest through Oregon to Portland, Tillamook and Coos Bay. The incorporators are: John P. Van Orsdel, C. M. Coney, Miller Murdock, Fenton Bldg.; and Robert Caples, all of Portland.

RICHMOND, URBANA & PENINSULAR. —A charter has been granted to this company in Virginia. The officers named in the charter are: John C. Robertson, of Chesterfield, Pres.; Boyce D. Brooker, of Richmond, Vice-Pres.; George C. Bland, of King and Queen, Treas.; James Taylor Robertson, of Chesterfield, Secy. The capital stock of the company is placed at from $100,000 to $300,000. Alexander B. Guigon is counsel for the promoters.

TEXAS.—J. F. BURNES & CO., of Devine, Tex., have been awarded contract for building 40 miles of railway from San Antonio to New Artesia, near Pleasanton, Tex. Noted on Oct. 15.

UTAH.—The Utah Copper Co., it is reported, will shortly commence the construction of its own standard-gage railroad between its mines and mills at Garfield, a distance of 10 miles. It will cost $1,000,000 to build this road, including the necessary equipment. After the building of this railroad, the company will consider the enlargement of its mill to handle 12,500 tons of ore a day, as against 7,000 tons daily at the present time. D. C. Jackling is First Vice-Pres. and Gen. Mgr., Salt Lake City, Utah.

WABASH-PITTSBURG TERMINAL. — Judge James S. Young, in the United States District Court on Oct. 30, handed down two orders that are of importance to the Wabash-Pittsburg Railroad. They mean, according to the Pittsburg "Dispatch," that almost $1,000,000 is to be expended in placing that line in first-class condition for operation. The orders grant to F. H. Skelding and H. W. McMasteir, receivers of the road, authority to issue receivers' certificates in the amount of $874,211. Out of this sum 14 tunnels are to be relined at a cost of $687,073 and 77 steel bridges are to be repainted at a cost of $63,136. Two locomotives, a steam derrick and other equipment and tools will be purchased for the line. The Court has under consideration a request from the receivers to expend $720,000 on the West Side Belt Line. Noted fully on July 23 and Aug. 20, 1908.

WESTERN MARYLAND.—B. F. Bush, Receiver of the Western Maryland Railroad, announced on Oct. 30, that his company is preparing to spend over $1,000,000 in new equipment. Bids have been asked from the construction companies of the country on 500 gondola steel coal cars, ten caboose cars, ten consolidated freight locomotives and three switch locomotives. The company also has in contemplation the ordering of 500 hopper cars, with an under frame of steel. This order, however, will be held until the first consignments, which are immediately needed, are placed and cared for. A. Robertson is Vice-Pres. and Gen. Mgr., Baltimore.

### ELECTRIC RAILWAYS.

(* *denotes that this work is advertised in Engineering News.*)

PITTSFIELD, MASS.—The Pittsfield St. Ry. Co. is having survey made for its proposed line through Hancock, Mass. Barnes & Spaulding, 28 West St., Pittsfield, are Engrs. As noted on July 16, "approval for a street railway location in Massachusetts that is expected to form a part of the through line projected between Buffalo and Boston has been asked of the Massachusetts Railroad Commissioners by a petition from the Pittsfield Electric St. Ry. Co. The proposed location would extend the lines of this company from Pittsfield to the New York-Massachusetts boundary, where a New York line is projected from Albany to meet it. The Pittsfield location begins at the boundary line between the city and Hancock, near the office of the West Pittsfield Shakers, and runs westerly on the State highway through the town of Hancock to the edge of the town of Lebanon, stopping at the State boundary. The Pittsfield directors signing the petition are Alex. Kennedy, J. L. Bacon, J. M. Stevenson, Charles E. Merrill and P. C.

Dolan." As noted July 2 "the Pittsfield Electric St. Ry. Co. has been granted a franchise to operate an electric railway in Hancock. About five miles of line will be built. P. C. Dolan, Pittsfield, is Pres. and Mgr."

BOSTON, MASS.—The Board of Railroad Commissioners on Oct. 28 began its hearings upon a resolve passed by the Senate last June, in which the Board was requested to investigate "what relations, if any, shall be permitted between railroad and street railway companies," and the specific inquiry as to whether the Berkshire Street Ry. Co. should be permitted to purchase the Bennington & North Adams Co. of Vermont, but which has a terminus in Massachusetts. Bentley W. Warren appeared as attorney for the Berkshire Co.

NEW YORK, N. Y.—The Public Service Commission on Nov. 9 will hold a hearing on the application of the New York, Westchester & Boston Ry. Co. for a certificate of public convenience and necessity, by which the company, which is controlled by the New York, New Haven & Hartford Railroad Co., hopes to resume the work of construction of a new line through the Borough of the Bronx and into Connecticut. Construction work was held up on the line by litigation, which has been recently decided by the Court of Appeals, which upheld the validity of the Westchester franchise.

ATLANTIC CITY, N. J.—The Atlantic City & Suburban Traction Co., according to the Philadelphia "Ledger," which cost $500,000 and never paid a dividend, was sold for $91,000 on Oct. 31. by Willard Morgan, of Camden, special master in chancery, to Robert Wetherill, of Chester, Pa., representing the Wetherill syndicate and a committee of the largest bondholders. The line extends from the Boardwalk at Florida Ave. to Somers' Point via Pleasantville, with a branch to Absecon. Creditors forced the appointment of John L. Clawson, of Philadelphia, as receiver, two years ago. Mr. Wetherill states that the bondholders would take charge at once and make extensive improvements to the line.

CARLISLE, PA.—The Cumberland Ry. Co. has been granted authority for an extension of its proposed railway. Noted on Oct. 22 under Balfour, Pa., the new extensions, as proposed, will be 13 miles long. W. E. Glatfelter is Pres., Balfour, Pa.

PITTSBURG, PA.—Joseph Ramsey, Jr., 160 Broadway, New York, states that arrangements have been made to provide funds for building an electric railway line between Pittsburg and the Susquehanna River, about 180 miles, the section of the road on which immediate construction is contemplated.

ALTOONA, PA.—At a meeting of the Merchant's Association and Chamber of Commerce on Oct. 25, definite action was taken looking to the construction of an electirc railway from this city to Bedford. It was decided to raise a fund of $20,000 to take care of the work of securing rights-of-way, profiles and a charter, as well as any other work that may be necessary to put the project in shape to present to the bankers. This part of the work is equal to 25% of the total and is considered as such and an asset for bonding.

ROANOKE, VA.—We are officially informed that surveys are in progress for the proposed Roanoke & Bent Mountain Ry. The line will run from Roanoke to Floyd, Va., 45 miles in length. Right-of-way will be donated. Motive power has not been decided. W. H. Price is Pres., Elliston, Va.; J. Coles Terry, First Vice-Pres., and A. F. Thornberry, Ch. Engr., both at Bent Mountain, Va. Noted on Aug. 13.

FAYETTEVILLE, N. C.—See item under Light and Power Plants.—Manchester, N. C.

JACKSONILLE, FLA.—Application for a charter will be made soon by the Suwannee River Ry. & Power Co., of Jacksonville. Company has been organized with a capital stock of $3,000,000 for the purpose of operating a series of electric railways extending 75 miles in four directions therefrom, also furnishing power for manufacturing purposes to many cities within the circle named. It is also the intention of the company to dam the Suwannee River, near White Springs, Fla., and erect a power station there. Among those interested in this enterprise are D. G. Zeigler, Atlanta, Ga.; Jasper R. Walker, and N. Johnson, White Springs, Fla.; J. H. Phillips, W. I. Phillips, Jacksonville, Fla. Arrangements have been made for floating $3,000,000 bonds for construction work, it is said. D. G. Zeigler & Co., Jacksonville, the Engrs., will begin to take bids on construction work in about 60 days.

BIRMINGHAM, ALA.—The Birmingham & Shades Mountain Elec. Ry. Co. has been organized to build an electric railway and a highway over Red Mountain, Shades Mountain and Shades alley. Stephen Smith and G. T. Brazelton, of Birmingham, are interested. The line will be six or seven miles long.

WINONA LAKE, IND.—Directors of the Winona Interurban Railway Co., at their annual meeting at Winona Lake on Oct. 29, subscribed $300,000 to rush completion of Warsaw-Peru Division, giving through service from Benton Harbor, Mich., to Louisville, Ky. S. C. Dickey, Winona Lake, is Gen. Mgr.

DETROIT, MICH.—Application has been made to the City Council for a franchise for the proposed Windsor Tunnel & Lake Erie Electric Ry., which contemplates building as soon as the proper authority can be secured from the city.

GALESBURG, ILL.—We are officially informed that the Galesburg, Aledo & Northwestern R. R. Co., which was recently incorporated to build an electric railway from Galesburg in a west and north direction, through the counties of Knox, Warren and Mercer, to Aledo, and from there through the county of Rock Island to Rock Island, Ill., and Muscatine, Iowa, has made surveys. Right-of-way has not been secured. This railroad will be 60 miles long. Motive power will be gasoline. B. F. Arnold, Galesburg, is Pres. Capital stock, $10,000.

GREEN BAY, WIS.—The Bay Shore Street Ry. Co. has been incorporated to construct a street railway to Bay Beach. Capital stock, $15,000. Headquarters, Green Bay. Incorporators: Fred A. Rahr, Frank E. Murphy and Arthur C. Neville.

PORTAGE, WIS.—J. N. Braun, of St. Paul, is interested in the promotion of an electric railway to be built here. Mr. Braun is Pres. of the Western Transportation Co., 317 American National Bank Bldg., St. Paul, which is organizing a company to build a line to be operated both by steam and by gasolene motor cars from Portage, Wis., north, via Briggsville, Oxford and Friendship to Grand Rapids, about 70 miles. Contracts for building the line are to be let as soon as incorporation is completed. The company proposes to take over the property and all the rights of the Sparta-Melrose Electric Railway & Power Co., of Wisconsin (which was organized with headquarters at Melrose, to build an interurban traction line from Sparta northwest via Angelo, Trout Fall and Cataract, to Melrose, 28 miles, on which construction work is to be started by the spring of 1909). The Western Transportation Co. will also incorporate a company to build a line from Galesville, Wis., to Ettrick.

MILWAUKEE, WIS.—The Wisconsin Rapid Transit Co. proposes to build an electric railroad system from a connection with the Chicago & Milwaukee Electric Railway, and run around the west side of Milwaukee, between West Allis and Milwaukee, and thence northwest to Templeton and Sussex and Holy Hill and Hartford, and thence north to Fond du Lac, Ripon, Green Lake and Berlin, a total of about 115 miles. Branches will be built from Theresa to Beaver Dam through Mayville, Horicon, Minnesota Junction and Rolling Prairie, about 23 miles; from Beaver Dam Junction to Minnesota Junction, and from Neosho to Watertown, a distance of about 40 miles; a branch line to Menominee Falls, a distance from the main line of four miles; also a 6-mile spur from Hartford to Cedar Lake via Schleisingerville, making a total of about 188 miles. Chas. D. Smith, Pres., Fond du Lac, Wis.

OMAHA, NEB.—J. W. Russell, Pres. of the Omaha, Council Bluffs & Des Moines Ry. Co., Adel, Iowa, advises us that nothing will be done toward constructing this line until next spring. As previously noted, this company was recently incorporated to build an electric line from Omaha to Council Bluffs, Iowa, thence northeast through Shelby to Harlan and then east, between the lines of the Chicago, Milwaukee & St. Paul and the Chicago, Rock Island & Pacific, through Audubon, Guthrie Center, Dale, Redfield, Adel and to Des Moines. Company is now taking subscriptions to capital stock. F. M. Hopkins is Vice-Pres., Guthrie Center, Iowa; H. H. Miller, Secy., Fort Dodge; E. L. Lockwood, Treas. Financial arrangements have been completed for constructing this line.

LITTLE ROCK, ARK.—We are officially informed that the Central Arkansas Elec. Ry. Co. will hold an election on Jan. 5, 1909, to elect new officers. This railway will extend from Little Rock to Pine Bluff and Hot Springs, 90 miles in length. Date for letting contracts will be let in January. Preliminary surveys have been made, and some right-of-way secured. Noted Sept. 24.

EL PASO, TEX.—Frank R. Tobin, Pres. of El Paso Suburban Railway Co., has presented to the City Council a petition for a franchise over the streets of the city from the city limits to the Union passenger depot. The petition sets forth that already five miles of the road has been constructed between the town of Tobin and Fort Bliss, and says that if the franchise is granted the work will be commenced within 90 days and completed within twelve months.

EL PASO, TEX.—The El Paso & Fort Hancock Railroad Co. will be incorporated to build an electric line between the two points named, 45 miles; but at first from El Paso only as far as Fabens, 32 miles. Charles N. Bassett is Pres.; Felix Martinez, Vice-Pres.; Winchester Cooley, Treas.; Thomas O'Keefe, Secy. Other directors are J. S. Reynolds, Richard Caples, J. M. Wyatt, Richard Burgess, John L. Dyer, J. L. Marr, B. F. Darbyshire, C. E. Kelly, Julius Krakauer, W. B. Latta and J. F. Williams, of El Paso. Capital, $100,000. Noted on Oct. 22.

The El Paso & Mesilla Valley Interurban Railway Co., which proposed to build a line from El Paso to Las Cruces, about 47 miles, has organized with $1,000,000 capital and the following directors: Z. T. White, of El Paso, Pres.; O. H. Baum, of El Paso, and B. J. Viljoen, of Champerino, Vice-Presidents; W. A. Sutherland, of Las Cruces, Secy.; Oscar C. Snow, of Mesilla Valley, Treas. Noted on Sept. 10.

OKLAHOMA CITY, OKLA.—We are officially advised that the Canadian Valley Ry. Co., which proposed to build a 150-mile interurban line connecting Fort Supply, Woodward, Mutual, Seiling, Canton, Geary, El Reno and Oklahoma City, has not decided upon date for commencing construction, and that the enterprise is not being pushed at present. As previously noted, this company was incorporated with a capital stock of $2,000,000. The motive power will be steam, electricity or gasoline. Thomas Martin is Pres.; E. O. McCann, Secy.; L. A. Foster, Treas., Mutual, Okla.

MANGUM, OKLA.—Right-of-way is now being secured by the Southwestern Interurban R. R. Co., it is announced. Later, the permanent survey will be made between Mangum and Francis, 22 miles. The company contemplates beginning construction work next spring. The road will connect Mangum, Granite, Altus, Blair, Hollis, Vinson, Reed and Cordell. The motive power will be electricity, it having already been decided to install the overhead trolley system. The power station and repair shops will be located at Mangum. Capital stock, $1,000,000. Office, Mangum. Officers: J. W. Solomon, Reed, Okla., Pres.; H. M. Ferguson, Mangum, Vice-Pres.; J. C. McCollister, Mangum, Secy.; James Duffy, Vinson, Okla. Treas.

EUGENE, ORE.—The Mackenzie River Power & Railway Co. has been incorporated in Portland, Ore., with a capital stock of $100,000, to build an electric line from Eugene, Ore., east to Belknap Springs and another from Blueriver, on the Mackenzie, north to Luckyboy, from which latter point there will be a branch southeast to Foley Springs. The incorporators include C. Sengstake, O. A. Lyman and Z. Snow, all of Portland.

## LIGHT AND POWER PLANTS.

(* *denotes that this work is advertised in Engineering News.*)

NEW YORK, N. Y.—The following bids were received on Oct. 30 by the Dept. of Public Charities, for (1) all materials and labor required for the complete conduiting, electric wiring and all other work in connection with the installation of a complete electric lighting and power system for the buildings and grounds under the jurisdiction of the Department of Public Charities, comprising and included in the Metropolitan Hospital District, Blackwells Island, Boro. of Manhattan, the City of New York. (2) All materials and labor required for the complete substation, substation equipment, pole lines and other work in connection with the lighting and power system for the Metropolitan Hospital district but not included in this district, Blackwells Island, Boro. of Manhattan, City of New York: Gore-Mecnan Co., (1) $68,393, (2) $65,000; E. J. Duggan, 1133 Broadway, (1) $50,000, (2) $33,000; Watson Flagg Engineering Co., 27 Thames St., (1) $84,995; L. K. Comstock & Co., 50 Church St., (1) $44,450, (2) $22,900; Lord Electric Co., 213 West 40th St., (1) $37,900, (2) $29,479; Cowden & DeYoung, (1) $50,929, (2) $28,472.

NEW YORK, N. Y.—We are officially advised that after a meeting of the Board of Directors of the Pennsylvania R. R. Co., held in Philadelphia on Nov. 2, the plans for the completion of the electrification of the Pennsylvania terminal in this city were announced and contract for the work was let to the WESTINGHOUSE ELECTRIC & MFG. CO., 165 Broadway, New York, and Westinghouse Bldg., Pittsburg, Pa. The contract provides for the electrification of the entire Pennsylvania system from Harrison, N. J., to Jamaica, L. I. The initial amount of the apparatus required under this part of the contract will be $5,000,000, but this is not the full amount that the work will cost, as it has not been determined how much more than the contract calls for will be done. Work on 100 electric locomotives will be begun at once and on a number of motor cars. To run the system 250,000 HP. will be required. The contract will cover a period of about two years. George Gibbs, 8 Bridge St., New York, is Ch. Engr. of Electric Traction for the Pennsylvania Terminal & R. R. Co.

ERIE, PA.—The Edison Electric Lighting Co. has purchased a site at the corner of Eleventh and French Sts. on which it will erect an addition to its power plant.

KITTANNING, PA.—The Kittanning & Leechburg Railways Co. contemplates increasing the output of its power plant by the installation of a 500-KW., 2,300-volt, 60-cycle, alternating-current generator, direct connected. T. A. Moesta is Pres.

STOYESTOWN, PA.—The Stoyestown Light, Heat & Power Co., of this city, has been formed by D. E. Long, J. E. Morgret, Earl Fulton, Herman Berkey and Valentine C. Muller, all of this town, and has been incorporated under the laws of this state, it is reported. The company will furnish electric light and power in Stoyestown and vicinity.

BALTIMORE, MD.—Additional electrical apparatus will be installed by the Washington, Baltimore & Annapolis Electric Ry. Co., 108 North Liberty St., Baltimore. J. N. Shannahan is Gen. Mgr.

BOONSBORO, MD.—The Antietam Electric Light & Power Co., Boonsboro, Md., will expend $15,000 to develop water-power. The company has a fall of about 10 ft., and it is estimated that 200 HP. can be obtained. Company has built penstock of solid masonry, using 200 bbls. of cement, and has constructed six miles of wiring, which will transmit power and light to Boonsboro and other cities. A 75-KW. generator, purchased from Western Electric Co., of Chicago, is being installed; two 39-in. turbines have been installed by S. MORGAN SMITH CO., York, Pa.; H. L. Moser prepared plans, and O. E. Shifler is Engr.-in-Charge.

BEDFORD CITY, VA.—The City Council will consider a proposition for construction of an electric-power plant. It is proposed to organize a company with $65,000 capital stock, acquire dam and acreage on James River and transmit 1,000 HP. to Bedford City, probably for distance of 25 miles.

MANCHESTER, N. C.—The Little River Power & Transmission Co., incorporated with $100,000 capital stock, has awarded contract to THOMAS B. WHITTED CO., Charlotte, N. C., for erection of a power plant and for equipment. The company has franchise for lighting Manchester, and will operate an electric street railway system at Fayetteville, N. C.

HENDERSONVILLE, N. C.—George Stephens, of Charlotte, N. C., will install an electric-power plant at Kanuga Lake Country Club, near Hendersonville, to furnish light and power for operating small woodworking plant.

ATLANTA, GA.—Bids are asked until 10 a. m., Nov. 30, by R. V. LaDow, Supt. of Prisons and Prisoners, Dept. of Justice, Washington, D. C., for furnishing and delivering at the U. S. Penitentiary, Atlanta, Ga., one 25-HP. electric motor and material.

DOTHAN, ALA.—The Choctawhatchie River Light & Power Co. has been incorporated with capital stock of $1,000,000, by W. C. Fritter, Morris Lumber Co., G. S. Kelly, W. H. Clark, G. and A. J. Smith. The company dam across the Choctawhatchie generate electricity for transmitting, power and manufacturing.

ELBA, ALA.—Bids will be received Pea River Power Co., for power-house recently burned. rett is Pres.; H. D. Boyd, Sec.

ST. BERNARD, LA.—The Sendering & Fertilizing Co. at has awarded a contract to the ELECTRIC CO., 730 Poydras leans, La., to install an electric works. The shell-road from the plant will be lighted by

A contract has been awarded Bernard Oil Refining Company, ville, to the COMMERCIAL E to install an electric lighting factory.

LIMA, OHIO.—We are offic that the Board of Public Serv lected C. E. F. Ahlm, Engr., Cleveland, Ohio, to prepare plans fications for the proposed muni light plant. Estimated cost, $

MADISON, WIS.—Bids are ask F. Porter, Secy. of the Wisco Comn., until Nov. 10, for the ing of the east wing of the under construction at Madison,

ST. CLOUD, MINN.—Plans are pared to make improvements to the Woolen Mills, which will include lation of new looms, a new dyna and lighting equipment, the cost is estimated at about $15,000.

McPHERSON, KAN.—Plans are sidered for improving and increasing the output of the plant of the McPherson & Electric Works, which will include installation of an engine and current generator. John T. Sa Mgr.

ELLINWOOD, KAN.—The contract for construction of the municipal electric light plant has been awarded to the MATHEWS ELECTRICAL CONSTRUCTION CO., Bldg., Kansas City, Mo., at $33,750. The W. K. Palmer Co., 718 Dwight Bldg., Kansas City, Mo., has charge of the engineering work.

HUBBARD CITY, TEX.—The Union Central Light & Ice Co., W. A. Bass, Pres., is planning to arrange for plans, specifications and construction of the proposed electric light plant.

FORT WORTH, TEX.—S. A. Tomlinson, of Fort Worth, has been awarded a contract for the construction of a power-house for the municipal electric light plant for $7,500. The equipment will include two engines and generator, the cost of which is estimated at $44,000. The plant will have sufficient output to supply electricity for 600 arc lamps in addition to the 200 lamps now in use. Lee Stephens is Comr.

TEMPLE, TEX.—Plans and specifications are being prepared by the W. D. Boyce Engineering Co., Chemical Bldg., St. Louis, Mo., for the construction of a power-house in Temple, in connection with the proposed interurban electric railway from Temple to Waco and Marlin, Tex.

ANADARKO, OKLA.—We are advised by J. E. Farmington, Chn. Purchasing Com., that the city of Anadarko has awarded contract to the ONEIL ENGINEERING CO., Dallas, Tex., to construct a dam on the Washita River and install water power, extend light, water and sewer systems and build a city hall. J. C. Stelzner, Mayor. Cost, $85,000.

STIGLER, OKLA.—The Stigler Light & Power Co., R. E. Stalcup, Pres., will establish an electric-light plant. It will install steam and electrical machinery, to cost $8,000.

DENVER, COLO.—The Denver City Tramway Co. will extend its street car system to Valverde, Overland Park and Fort Logan Districts. The company also plans to construct a new substation, the equipment of which will include two 500-KW. rotary converters. John Evans is Ch. Engr.

PORT ORCHARD, WASH.—William Radley probably will apply for a franchise to construct and operate an electric light and power plant and water-works system in Port Orchard. It is proposed to construct a dam on Blackjack Creek to furnish power to operate the electric plant, and to dig wells, the water from which will be pumped and distributed by electrical power.

SPOKANE, WASH.—The Washington Water Power Co. has awarded contract to the I. P. MORRIS CO., Beach and Ball Sts., Philadelphia, Pa., for the installation of four water wheels, each with a rating of 9,000 HP. with a head of 68 ft. The plant is to be located on the Spokane River, about 15 miles west of Spokane, and will furnish electricity for lamps and motors for towns in the vicinity of Spokane. D. L. Huntington, Spokane, is Gen. Mgr.

PORTLAND, ORE.—The contract for the installation of a 600-HP. hydro-electric plant for the Three Sisters Mining Co. has been awarded to EDWIN G. AMME, of Portland, Ore. The plant will be equipped with individual motors for all machinery.

SACRAMENTO, CAL.—See item under Water Supply—Irrigation.

SACRAMENTO, CAL.—The Mojave Water & Power Co. has been incorporated with a capital of $2,000,000. It is stated that P. Hammon, Oroville, is interested.

MODESTO, CAL.—The La Grange Dredging & Power Co., which recently secured a franchise to furnish electricity in Turlock, will commence work at once on the construction of a dam on the Tuolumne River. The transmission line to Turlock is to be completed within four months and will be followed by the extension of transmission lines to Modesto and other places in the San Joaquin Valley. The company is planning to construct electric railways in this part of the valley from the Sierras to the Co

Range, E. A. Wiltsee and John Hays Hammond, both of 165 Broadway, New York, N. Y., are interested. Noted on Oct. 22.

HAMILTON, ONT.—The contract for motors and [illegible] for the Beach Pumping Station was awarded by the fire and water committee to the CANADIAN WESTINGHOUSE Co., Sovereign Bank Bldg., Montreal, Que., for $20,148. The contract for a [illegible] water to the mountain top system to [illegible] JOHN MONTGOMERY CO., of Toronto, for $6,500.

SAULT STE. MARIE, ONT.—L. H. Davis, Ch. Engr., writes us that the Lake Superior Power Co. is getting contracts for a water power plant at cost $110,000. The plant will have a capacity of 6,300 HP. at the turbine shaft and 4,200 HP. at the switchboard.

VANCOUVER, B. C.—The British Columbia Electric Co. is planning to build a dam at Coquitlam Lake to furnish additional power for its plant. R. H. Sperling, of Vancouver, B. C., is Gen. Supt.

## BRIDGES.

*(* denotes that this work is advertised in Engineering News.)*

NEW HAVEN, CONN.—The New York, New Haven & Hartford R. R. Co., Edward Gagel, Chf. Engr., New Haven, contemplates erecting a viaduct over its tracks, at Bridge St., 250 ft. in length. Estimated cost, about $150,000.

NEW YORK, N. Y.—See item under Buildings.

PITTSBURG, PA.—The New Liberty Bridge Co. of the city has been incorporated by John F. and P. H. Mueller, 6335 Walnut St., Pittsburg, and Adolph Stredling, Pittsburg, to erect a single span bridge across the Monongahela River from a point in the Sixth Ward 425 ft. east of the Pennsylvania R. R. to Manor St., South Side, where the bridge will connect with the proposed tunnel system to be built by the same incorporators through Mount Washington. The bridge will be of steel, and will be about 2,000 ft. long.

BALTIMORE, MD.—We are officially advised that the Harbor Board will remove the present bridge on Pratt St. crossing Jones' Falls, and replace it with a reinforced-concrete bridge 120 ft. in width. No plans or specifications have yet been drawn nor will be done until such a time that the appropriation asked for the construction of this bridge has been allowed. If the necessary appropriation is allowed bids will be advertised on or about March 1. O. F. Lackey is Harbor Engr. Noted Oct. 29.

TAKOMA PARK (Washington post-office), D. C.—The City Council received bids as follows on Oct 24 for constructing a concrete and steel bridge over the Sligo Stream at Carroll Ave.: William A. Fry, of Washington, D. C., $15,655; Lake Stone Co., of Washington, D. C., $15,560; Washington Sanitarium Association, of Takoma Park, $12,700. All the bids were rejected and new bids are asked until Nov. 11.

HANOVER, VA.—Bids will be received until Nov. 25 by the State Highway Commissioner, Richmond, Va., for constructing a steel and reinforced-concrete bridge over Chickahominy River on the road from Fair Oaks to Cold Harbor, between Hanover and Hanrico Counties. Thomas R. Puller is Chn. Joint Comn.

*LYNCHBURG, VA.—We are officially advised that bids were received as follows on Oct. 26 by the Council Committee on Streets for placing new stringers under street car tracks, and lacing top chords, Rivermont viaduct, the approximate quantities of the work being 101.5 tons channels in stringers, 6.4 tons lace bars, 18,260 ft. B. M. lumber. W. W. Lindsay & Co., Harrison Bldg., Philadelphia, Pa., $9,750; Laner & Harper, $8,-780; Virginia Bridge & Iron Co., Roanoke, Va., $8,980; George A. Dietrich & Bro., Richmond, Va., $9,890; Jones & Adams, Lynchburg, $10,340; Carolina Engineering Co., $8,250; Owego Bridge Co., Owego, N. Y., $8,212; Nelson Merydith Co., Lewis Block, Pittsburg, Pa., $8,518; Joliet Bridge & Iron Co., Joliet, Ill., $8,737. H. L. Shaner is City Engr.

*BEAUFORT, N. C.—Plans and specifications are on file at the office of Engineering News, New York, for the construction of a steel draw-span highway bridge with pile and concrete foundations on Core Creek. Bids are asked until Nov. 20.

CHERAW, S. C.—The city has awarded the contract to the JOLIET BRIDGE & IRON CO., Joliet, Ill., for the construction of a steel suspension bridge over the Great Pee Dee River, at $18,684.

AUGUSTA, GA.—The Bridges and Wharf Committee of the City Council has recommended that the bid of J. H. McKenzie's Sons, of Augusta, be accepted, at $20,880, for piers for a draw span at the Center St. bridge.

GULFPORT, MISS.—Harrison County has voted $50,000 of bonds for road and bridge improvements.

BRIDGEPORT, OHIO.—The County Commissioners have awarded the contract for constructing a bridge over Wheeling Creek here to the CAPITAL CONSTRUCTION CO., of Columbus, Ohio, at $9,864.

*CINCINNATI, OHIO. — The contract for the construction of the superstructure of the viaduct for the terminal track from Eighth St. and McLean Ave. to Third and Front St., has been awarded by the Board of Trustees of the Cincinnati Southern Ry. Co. to the KILBY-CONLEY MFG. CO., 55 Water St., Pittsburg, Pa., at $165,244. List of bidders noted on Oct. 22.

GARY, IND.—W. F. Bridge, of Hammond, Ind., has prepared plans for the construction of a bridge across Little Calumet River at South Broadway. Charles Johnson is County Audr., Crown Point, Ind.

FRANCETON, IND.—County Commissioners have rejected all bids for constructing and repairing 30 county bridges. New bids will be [illegible] The Vincennes Bridge Co., Vincennes, Ind., submitted the lowest bid, at about $13,000. Harry Embree is County Audr.

WHITEFISH POINT, MICH.—Bids are asked until Nov. 11 by Frank House for constructing a bridge over the Tahquemanon River.

CHILLICOTHE, ILL.—The MISSOURI BRIDGE & IRON CO. has been awarded the contract, at $3,299, for constructing a bridge here to be of steel and iron, 80 ft. long, main span, 16-ft. roadway of 3-in. oak floor with a 34-ft. approach of like roadway floor, resting on concrete masonry abutments with wings and on two steel tubes.

CHICAGO, ILL.—Bids are asked by the Department of Public Works until 11 a. m., Nov. 10, for furnishing, delivering and building in place all temporary work, and for furnishing all materials, tools, labor, and all appliances and appurtenances required in the performance of all necessary operations for the complete construction and erection of the superstructure of a bridge over the Illinois and Michigan canal at South Ashland Ave. Plans and specifications on file in the office of the Department of Public Works, 801 City Hall. John J. Hanberg is Comr.

CHICAGO, ILL.—The KELLY-ATKINSON CO., 188 Madison St., Chicago, has been awarded the contract by the Sanitary District of Chicago for the erection of the superstructures and flooring for three highway bridges, at $9,983.

The contract for the construction of the substructure of a railway bridge for the Mayfair cut-off has been awarded by the Sanitary District of Chicago to J. T. FANNING & CO., at $67,955 for excavation and concrete work.

GRUNDY CENTER, IOWA.—Bids are asked until noon, Nov. 9, by E. G. Ensminger, County Audr., for furnishing the county with bridge lumber for 1909.

WINFIELD, KAN.—The County Commissioners have awarded the contract for constructing a bridge over Silver Creek in Liberty Township, and one over Cedar Creek in Cedar Township, to WALTER SHARP. Bids were opened on Oct. 15.

ATCHISON, KAN.—The MISSOURI VALLEY BRIDGE CO., Leavenworth, Kan., has secured the contract, at about $12,000, for the construction of 20 steel and concrete bridges for Atchison County. Edward Iverson is County Clk.

HELENA, MONT.—The Commissioners of Lewis and Clark Counties have awarded the contract for the erection of a steel bridge over the middle fork of the Dearborn River to the MINNEAPOLIS STEEL & MACHINERY CO., Minneapolis, Minn. Other bidders were: Charles G. Sheely, $4,792; O. E. Peppard, $4,642.

ST. LOUIS, MO.—The PENNSYLVANIA STEEL CO., of Steelton, Pa., has been awarded the contract by the city for constructing steel superstructure of the McKinley bridge. Estimated cost, between $500,000 and $600,000.

MENA, ARK.—An appropriation of $9,000 has been made by county for constructing three steel bridges.

BATESVILLE, ARK.—The County Court has decided to have five steel bridges constructed.

ELMA, WASH.—All bids for constructing a bridge over the North River have been rejected as excessive and the County Auditor has been instructed to advertise for new bids.

PORTLAND, ORE.—Ralph Modjeski, of Chicago, Ill., has submitted to the Council his report on the construction of a bridge over the Willamette River or a tube under the river, recommending the construction of a drawbridge, to be erected north of the steel bridge. Estimated cost, $1,500,000. The west approach would be near the Union Depot and the east approach at Broadway and Larrabee St. He estimates the cost of two tubes under the river, which would be necessary to care for all traffic, at $2,800,000.

LOS ANGELES, CAL.—Bids are asked until 2 p. m., Nov. 9, by the County Supervisors, C. G. Keyes, Clk., for labor and material for constructing a pile trestle bridge over the Los Angeles River at Florence Ave. in San Antonio Road District; also for the construction of a reinforced concrete culvert over Dalton Wash, on Central Ave., in the Azusa Road District.

REEDLEY, CAL.—The County Supervisors have directed the County Surveyor to prepare plans and specifications for the construction of a bridge line. Estimated cost, $5,000.

VISALIA, CAL.—Bids will be received by the Clerk of the Board of Supervisors until 10 a. m., Nov. 10, for the construction of a bridge across Kings River. Eugene L. Scott is Clk.

POCATELLO, IDAHO.—The Boards of Commissioners of Bannock and Bingham Counties have awarded the contract for the construction of the Tilden bridge to the DENVER BRIDGE CO. for $10,300.

COEUR D'ALENE, IDAHO.—The contract for the construction of an 800-ft. trestle has been let by the County Commissioners to CARSCALLEN BROS., at $2.50 a lin. ft. Only one other bid was submitted.

BRADFORD, ONT.—The York County Commissioners have awarded the contract for filling at the Holland River bridge to THOMAS ART, of Holland Landing, at the following prices: Earth fill, 60 cts. per cu. yd.; gravel filling, $1 per cu. yd.

## BUILDINGS.

*(* denotes that this work is advertised in Engineering News.)*

LYNN, MASS.—Plans have been prepared by Josephine Wright Chapman, 11 West Eighth St., New York, N. Y., for a woman's club house, to be erected on Broad St., Lynn, at the corner of Nahant St. The building will be erected for the Lynn Women's Club Corporation at a cost of $60,000.

BOSTON, MASS.—George A. Hibbard, Mayor of Boston, is considering the question of erecting a city hall here. The only site that the mayor at present has under consideration is the Park Sq. property of the New York, New Haven & Hartford R. R. Co. J. Richard Carter, of the Boston Merchants' Association, is interested.

The Quartermaster General of the Marine Corps, Washington, D. C., has rejected all bids recently received for the construction of marine barracks at the Boston Navy-Yard. The bids received were in excess of the appropriation and an effort will be made to secure an additional appropriation. If this is done the contract will be readvertised.

FORT ANDREWS (Boston post-office), MASS.—The following contracts have been let for construction of a single set Field Officer's quarters, one 5-set Bachelor Officer's quarters, two double sets non-commissioned officers' quarters and one barrack for one company of coast artillery: Masonry, CHAS. E. CURRIER CO., 110 Summer St., Boston, $80,980; carpenter work, DARLING & SLADE, Fall River, Mass., $82,263; heating, NEWPORT PLUMBING & HEATING CO., INC., Newport News, Va., $13,883; plumbing, HEALY HEATING & PLUMBING CO., 277 West Third St., St. Paul, Minn., $15,819. Capt. Ira L. Fredendall, Constr. Q. M., 263 Summer St., Boston.

CHELSEA, MASS.—Work will be begun soon on the Williams School which, according to present plans, is to be the center of one of a group of school buildings. The central building will be located on a site enclosed by Arlington, Walnut, Fourth and Fifth Sts. This is a double city block 550 ft. in length and 260 ft. wide. The building will contain 20 classrooms, an assembly room capable of seating more than 1,000 persons, and a central heating plant. At some future time as the needs require it is the idea of the city to erect two other buildings at the right and left from Walnut St., the three buildings inclosing a court 300 × 130 ft. The buildings will be of the fireproof construction of red brick, with trimmings of light terra cotta. There will be four fireproof staircases in the central building. The architects are Kilham & Hopkins, 9 Park St., Boston.

GREENWICH, CONN.—We are officially advised that William F. Dominick, Arch., 3 West 29th St., New York, has let general contract to HOGGSON BROS., 7 East 44th St., New York, for a church, at Greenwich, for the Christ Church Parish, Rev. M. George Thompson, Rector. Cost, $100,000.

HARTFORD, CONN. — Proposals for the construction of the fire engine house to be built on Fairfield Ave. (the original bids for which were rejected as the cost exceeded the appropriation) will be received by the Board of Contract and Supply, James P. Berry, Secy., until 11 a. m., Nov. 9.

NEW YORK.—W. H. Coakman, Arch., Pennsylvania R. R. Co., Philadelphia, advises us that the contract for constructing a steel and galvanized iron storage shed building with 40,000 sq. ft. floor space was let on Oct. 30 to ARMSTRONG & LATTA CO., Land Title Bldg., Philadelphia. Cost, $60,000.

NEW YORK, N. Y.—Bids are asked until 3.30 p. m., Nov. 16, by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Education, for additions, repairs and alterations to heating apparatus in Public School No. 14, Eastern Boulevard, Throggs Neck, Boro. of the Bronx; for forming classrooms on fifth story of Public School No. 184, on 116th and 117th Sts., east of Lenox Ave., Boro. of Manhattan; for furniture, equipment, etc., for the athletic field on Munson and Orchard Sts., and East River front, Astoria, Long Island City, Boro. of Queens.

NEW YORK, N. Y.—We are officially advised that the general plans of McKim, Mead & White, Archs., 160 Fifth Ave., for the proposed municipal office building, have been filed with the Building Department. They call for an expenditure of $8,000,000. The building is to be erected on the two blocks bounded by Tryon Row, Centre St., Duane St. and Park Row. It will be a steel frame structure, faced with granite and limestone, covering an irregular shaped area of about 70,000 sq. ft., 25 stories high and surmounted by a tower rising about 200 ft. above the roof line. The total height of the building will be about 550 ft. above the street. Contract for the foundations will be advertised for in about a week by James W. Stevenson, Comr. of Bridges, Park Row Bldg. Noted on April 30 and June 18.

Following are the bids received on Oct. 23 at the office of John F. Ahearn, Pres. Borough of Manhattan, for repairs and alterations to the Hall of Records (including extension of the electric lighting equipment, repairs to rooms on the sixth and seventh floors, etc.): George W. Cobb, 144 Nassau St., $46,230; John T. Brady Co., 103 Park Ave., $47,830; A. & W. Gray Co., 237 West 37th St., $46,700; William Werner, 892½ Forest Ave., $51,845, and N. B. Smythe, 1123 Broadway, $46,430.

Plans have been filed for a 6-story apartment house, to be built for the Young Realty Co., Charles G. Wallas, Pres., on 144th St., east of Broadway, on Washington Heights. It is to be of French Renaissance design, with a frontage of 100 ft. and a depth of 86.11 ft. the facade being of brick, with stone trimmings. It is to cost $120,000.

NEW YORK, N. Y.—Bids are asked until 2.30 p. m., Nov. 12, by Robert W. Hebberd, Comr. of Public Charities, for providing all labor and materials, including chambers, cars formaldehyde retorts, transfer table, tracks, sleepers, tees, valves, piping and all other work necessary to the installation of a combined steam and formaldehyde disinfecting system (except the supplying and installation of a vacuum pump) for the new municipal lodging house, situated approximately 400 ft. east of First Ave., and on the southerly side off 25th St., Boro. of Manhattan.

Bids are asked until 2.30 p. m., Nov. 13, by Robert W. Hebberd, Comr. of Public Charities, for furnishing all the labor and materials required for removing the four hospital pavilions located on the grounds of Bellevue Hospital and erecting same at the Metropolitan Hospital; also for altering the position of six hospital pavilions now at the Metropolitan Hospital.

The Putnam House, on Fourth Ave., opposite the Madison Sq. Garden, is to be razed to give place to a 12-story and basement loft and office building, for which plans were filed with the Building Superintendent by William C. Hazlett, Arch., 1135 Broadway, for the Putnam Holding Co., of which Varick D. Martin is Pres. The building will be fireproof and of the modern Renaissance design. It will cost $380,000.

Plans have been filed with the Building Superintendent for a 6-story apartment house to be built for the Fluri Construction Co., at the corner of Fort Washington Ave. and 180th St. It is to be of the Renaissance design, of brick, with limestone trimmings, having a frontage of 100 ft. and a depth of 134 ft. It will be fitted with eight suites to the floor. It is to cost $210,000. Schwartz & Gross, 347 Fifth Ave., are Archs.

NEW YORK, N. Y.—We are advised by Schwartz & Gross, Archs., 347 Fifth Ave., that estimates will be received in about a week for the construction of two 12-story elevator apartment houses, 198.4 × 100 ft. for the Carlyle Realty Co., 198 Broadway, to be erected in the north side of 190th St., east of Broadway, and to cost together $700,000. There will be four family apartments on each floor. Estimates will be taken on elevators, boilers, heating, electric pumps, tanks, ornamental iron, concrete arches, trim parquet, vacuum cleaners, etc.

On Oct. 27, the Board of Aldermen voted to appropriate the following: $2,250,000 for the Rikers Island Penitentiary; $155,000 for a wing to the Kings County Hospital; $27,000 for a playground in the 16th Ward, Brooklyn; $94,622 for a bridge over the Shore Road; $75,000 for cleaning 87 miles of macadam roads in the Boro. of Brooklyn.

Work will be begun immediately in the Martense Section of Brooklyn, adjoining Borough Park on the north and extending east and south of that development, erecting 200 3-story brick and stone apartment houses, to cost about $20,000 each. The work will start on 43d St., between 15th and 16th Aves., where the first row of 48 buildings will be erected. The structures will be built for investment by the Realty Trust Co., 60 Liberty St., New York, from plans by Albert Swasey.

ROCHESTER, N. Y.—It is stated that a fireproof theatre 106 × 165 ft. will be erected at a cost of $750,000 on Clinton Ave. South, this city, by J. H. Moore, Cook Opera House.

BUFFALO, N. Y.—The Buffalo Seminary, Chas. E. Walbridge, Chairman Board of Trustees, has awarded to METZ BROS., 221 Bryant St., Buffalo, the general contract for construction of an academy building, two stories and basement, 147 × 37 ft., with a wing 43 × 74 ft., to be erected at Bidwell Parkway and Potomac Ave. The structure will be of light gray brick with Indiana limestone and terra cotta trimmings and slate roof; Cost, $100,000. George F. Newton, 6 Beacon St., Boston, Mass., is Arch.

The contract for foundations for the group of three buildings for the Homeopathic Hospital, to be erected at Linwood and Lafayette Aves., has been let to METZ BROS., 221 Bryant St. The main building will be 217 × 44 ft., two stories high; administration building, 53 × 45 ft., two stories; and a building for nurses' home, 120 × 30 ft., two stories. Plans for superstructure of these buildings are being revised and new bids will be asked for. Ernest Montgomery is Chn. Bldg. Com., and George F. Newton, 6 Beacon St., Boston, is Arch.

BRIARCLIFF, N. Y.—Guy King., Arch., 1513 Walnut St., Philadelphia, awarded contract to JOHN C. YDALL, New York, for an addition to a hotel for the Briarcliff Hotel Co., Briarcliff. Cost, $200,000.

SYRACUSE, N. Y.—Esenwein & Johnson, Archs., 777 Ellicott Sq., Buffalo, have been retained to prepare plans for the Onondaga Hotel to be built in this city at a cost of $800,000.

ATLANTIC CITY, N. J.—Walter D. Prouse & Co., Land Title Bldg., Philadelphia, Pa., are taking estimates on two 8-story apartment houses, of concrete, to be built at Atlantic and Pacific Aves., on Hartford Ave., Atlantic City. Each building will contain 48 8-room suites and will occupy a lot 100 × 280 ft. Henry Ives Cobb, 42 Broadway, New York, is Arch. The total cost will be about $450,000.

WEEHAWKEN, N. J.—Crow, Lewis & Wickenhoefer, Archs., 160 Fifth Ave., New York, have let general contract to CHARLES H. NEILSON, Town of Union, N. J., for a 1-story bank building for the Weehawken Trust Co., Weehawken. Cost, $75,000.

HAZELTON, PA.—Bids are asked until 3 p. m., Nov. 25, by James Knox Taylor, Supervy. Arch., Treasury Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. post-office at Hazelton.

PHILADELPHIA, PA.—Work will be begun immediately on a 7-story building, of reinforced concrete, at 1306 Chestnut St., for George Miller. The lot has a front of 18 ft. on Chestnut St., with a depth of 102 ft. to Drury St. Plans for the building were made by Ballinger & Perrot, 1200 Chestnut St. The contract for the building which will cost $45,000, has been awarded to HERBERT E. HAVENS, Girard Bldg. When completed it will be occupied by F. A. North & Co., piano dealers.

Bids are asked by Stearn & Castor, Archs., Stephen Girard Bldg., until Nov. 10, for remodeling the 3-story lodge building, for the Scottish Rite Consistory, W. B. Smith, Secy. Cost, $100,000.

Henry S. Reinhold, Jr., Arch., 1004 Chestnut St., has prepared sketches for a 3-story theater, at West Philadelphia, for a syndicate now being formed. Cost, $200,000.

Bids are asked until Nov. 6 by the Commissioner on Property of the Board of Education, William Dick, Secy., for erecting a

24-division building at 19th and Butler Sts., 38th Ward; a 21-division building at 28th and Morris Sts., 36th Ward; wing at the Thomas G. Morton School, 63d and Elmwood Ave., 40th Ward, repairs to tiled walls, Central High School, Broad and Green Sts.; for additional radiators, Hoffman School, 55th and Vine Sts.; for new partition, N. E. Grammar, Lawrence and Race Sts., etc.

SHARON, PA.—James Knox Taylor, Supv. Arch., Treasury Dept., Washington, D. C., has awarded to C. V. BEATTY, East Liverpool, Ohio., contract for the construction of a post-office building at Sharon, Pa., at $54,681.

PITTSBURG, PA.—The Building Committee of the East Liberty Y. M. C. A., has awarded contract to W. B. BENNETT, 742 North Negley Ave., Pittsburg. The new building will have a frontage of 80 ft. on Whitfield St., at Mignonette St., and a depth of 132 ft. Thomas Hannah, Diamond Bank Bldg., Pittsburg, is Arch.

FORT DU PONT (Delaware City post-office), DEL.—Bids for the erection of a new barracks building at Fort Dupont, have been scheduled as follows: Lynch Bros., $71,100; George A. Glenn & Co., $74,423; Horace B. Deal Co., $77,259; Edward Fay & Son, $77,-638; Read & Bro., $77,800; F. C. Clark, $78,-212; Charles McCaul Co., Philadelphia, $88,-961; Charles W. Denny, $90,105; Anderson & Co., $91,541; Mitchell & Co., New York, $91,911; Sax & Abbott, $92,300, and Miller & Co., $93,115. The contract has not yet been awarded.

BALTIMORE, MD.—The Pennsylvania R. R. Co. has laid plans before the City Commission for Improvement of Railroad Terminals in Baltimore for a union station to cost between $700,000 and $1,000,000. The total floor space will be 30,000 ft., with a general waiting-room space of 8,160 sq. ft. The station will be located between Maryland and Guilford Aves., will occupy a block and take in the present site. As the Pennsylvania trains pass through the city underground, passengers will have to descend to the trains, but the waiting-room will be on a level with the street. The general design for the structure has not been prepared, but it will be of the Colonial type. The building probably will be 100 × 300 ft. Alexander C. Shand, Philadelphia, is Ch. Engr.

WASHINGTON, D. C.—Bids were received as follows Oct. 31, at the office of the Commissioners of the District of Columbia, Washington, D. C., for the construction of a second addition to the McKinley Manual Training School, Seventh St., near Rhode Island Ave., Washington: Thomas H. Melton, 621 F St., N. W., $60,990; George A. Fuller Co., Munsey Bldg., $51,800; Pavarini & Wyne, Inc., Munsey Bldg., $51,000; Robert T. Humphreay, $65,000; Thompson-Starrett Co., Commercial National Bank, $52,500; W. E. Mooney, Lenman Bldg., $66,854; Burgess & Parsons, 627 F St., N. W., $59,100, all bidders of Washington, D. C.

NORFOLK, VA.—J. W. DAVIS, of Newport News, Va., has been awarded the contract for constructing the proposed high school. His bid was $300,990.

MANCHESTER, VA.—Bids are asked until 3 p. m., Nov. 30, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (complete) of the U. S. post-office at Manchester, Va.

CHARLESTON, S. C.—See item under Miscellaneous Contracts.—Freight elevators.

GAINESVILLE, GA.—Bids are asked until 3 p. m., Dec. 8, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (complete) of the U. S. post-office at Gainesville.

TAMPA, FLA.—The contract to erect the Y. M. C. A. Building has been awarded to F. W. MILLER, of Tampa, at about $70,000. Bonfoey & Elliott, of Tampa, are Archs.

BIRMINGHAM, ALA.—We are officially advised that T. C. THOMPSON & BROS. have the contract for the construction of both the Chamber of Commerce Building and the Empire Building. The former is to be 100 × 100 ft., seven stories high, the latter will be 17 stories high. Warren & Welton, Title Guarantee Bldg., are Archs. for both buildings. J. S. Calhoun, Jr., is Supt. of Constr., Hood Bldg.

BILOXI, MISS.—Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until Nov. 23, for the construction of quarters and executive buildings at Gulf Quarantine Station, Ship Island, Miss.

ALEXANDRIA, LA.—A city hall costing about $60,000 is to be erected here. Contract for the construction will be let about Nov. 23.

CINCINNATI, OHIO.—Bids are asked until 2 p. m., Nov. 27, by Col. William T. Rossell, Corps Engrs., U. S. A., Cincinnati, for building a warehouse at Dam No. 37, Ohio River.

YOUNGSTOWN, OHIO.—The MAHONING LUMBER CO., has been awarded the contract for building the Scott-Jones block at 254, 256 and 258 West Federal St., and the work is to be completed April 11, 1909. It will be four stories high, of brick and iron. It will have a frontage of 45 ft. on Federal St. and will extend back 130 ft. Owsley & Boucherie, Wick Bldg., drew the plans for the building which will cost about $75,000.

Bids will be received until Nov. 16 by the Board of Education for furnishing material and installing ventilating, heating and sanitary apparatus in the Fremont Ave., School. Separate bids will be received same time and place for $56,000 school improvement bonds. W. N. Ashbaugh is Clk.

OXFORD, OHIO.—Bids are asked until noon, Nov. 21, by the Board of Trustees, of the Miami University, Oxford, for the erection and completion of a building for normal school purposes at the Miami University, Oxford. Frank L. Packard, New Hayden Bldg., Columbus, Ohio, is Arch. O. V. Parrish is Secy. Special Bldg. Com.

INDIANAPOLIS, IND.—We are officially advised that plans will be received about Nov. 20 for the erection of a city hall building on the city's property at the corner of Ohio and Alabama Sts., at a cost of about $600,000. Charles G. Davis is Chn. Bldg. Com., Baldwin Block. (This is a postponement from Oct. 15, and Nov. 2.)

L. B. Millikan, Edward Pugh and others have ordered plans for the erection of building and the improvement of an amusement park at Riverside. Estimated cost, $80,000.

FRANKLIN, IND.—CALDWELL & MOBLEY, of Hammond, Ind., have secured the contract to erect the high school, at about $40,831.

FORT WAYNE, IND.—FREDERICK J. RUMP has secured the contract to erect on Calhoun St., for the People's Trust & Savings Co., a 6-story office building to cost $50,000.

SOUTH BEND, IND.—The South Bend Lodge, No 29, I. O. O. F., will ask for bids soon for the erection of a business block the upper or sixth floor to be used for a lodge hall. The Trustees will award the contract.

ANN ARBOR, MICH.—The Board of Regents of the University of Michigan let entire contract to KOCH BROS., Ann Arbor, at $75,063, for an addition to the Engineering Building. Shirly M. Smith is Secy.; Albert Kahn, Arch., Union Trust Bldg., Detroit.

CHICAGO, ILL.—Bids will be received until 1.30 p. m., Nov. 23 by the Board of County Commissioners, addressed to William McLaren, Supt. Pub. Service, 519 Cook County Court House, Chicago, for erecting the proposed County Infirmary at Oak Forrest, about 18 miles from Chicago, according to plans prepared by Holabird & Roche, Archs., 1618 Monadnock Bldg.

CHICAGO, ILL.—Bids are asked by the Committee on Buildings and Grounds at office of Business Manager of the Board of Education, 730 Tribune Bldg., until noon, Nov. 11, for work at the Carl Schurz High School, Addison St. and Milwaukee Aves. D. H. Perkins, Arch. T. J. Waters, Engr., Tribune Bldg.

We are officially advised that the contract for the erection of the new passenger depot of the Chicago & Northwestern Ry. Co., on West Madison St., has been let to the GEORGE A. FULLER CO., Marquette Bldg., Chicago, and Fuller Bldg., New York. The contract calls for the expenditure of approximately $5,000,000 and stipulates that the new depot shall be completed within two years from the time work is begun. The station is to be of classic design, with a colonnaded entrance or portico of monumental appearance, 120 ft. in height. The arrangement of the ground floor will be such that it will be possible to handle 30,000 suburban passengers in and out of the station without their coming in contact with through passengers. The train shed will be 840 ft. long and 320 ft. wide, and will contain sixteen tracks, each with a capacity of fifteen cars. E. C. Carter, Chicago, is Ch. Engr.

MILWAUKEE, WIS.—The Building Committee of the School Board has recommended construction of a $60,000 addition to the West Side High School in the spring; additions to 14th District School, No. 1; to 17th District School No. 1, and 18th Distriect School No. 1. Total cost to be about $125,000.

ST. PAUL, MINN.—H. Kretz & Co., Archs., New York Life Bldg., are preparing plans for a 4-story pressed brick and cut stone, fireproof wholesale building to be built on Fifth St., near Robert St., for the P. J. Bowlin Liquor Co., 381 Jackson St. Cost, $60,000.

The contract for the general construction of the Masonic Temple at Sixth St. and Smith Ave., has been awarded by Buechner & Orth, Archs., Manhattan Block, to CHARLES SKOOGLUN, 1015 Jessie St., at $150,000.

DULUTH, MINN.—J. J. Wangenstein, Arch., 401 Providence Bldg., has prepared plans for an 8-story building to be erected for the Dewitt-Seitz Co. It will be of brick and will cost approximately $60,000.

FERGUS FALLS, MINN.—The State Board of Control, P. M. Ringdal, Chn., has awarded the contract for an addition to the state insane hospital at Fergus Falls, Minn., to LAURITZEN BROS., Fergus Falls, at $65,-000.

MITCHELL, S. DAK.—The Board of Education has let general contract to MOORE & DANNER, of Kokomo, Ind., at $51,870, and heating and plumbing to HESS, RAU & CO., at $15,787, for the erection of a high school building. C. W. Downey is Clerk; Patton & Miller are Archs., 140 Dearborn St., Chicago.

RAWLINS, WYO.—Bids are asked until 3 p. m., Nov. 19, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (complete) of the U. S. post-office at Rawlins.

CARTHAGE, MO.—Bids were received as follows Oct. 30, at the office of James Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C., for the construction of a post-office at Carthage, Mo.: Carl A. Nilson, Kansas City, Mo., $94,334; Wright, Logan & Jackson, Carthage, Mo., $88,733; J. A. Daly, Nevada, Mo., $83,858; Deiter & Menzel Construction Co., Wichita, Kan., $79,370; Charles S. Davis Neosho, Mo., $94,185; E. A. Steinmeyer Construction Co., St. Louis, $79,-797; Hiram Lloyd Bldg. & Construction Co., St. Louis, $83,997; M. Yeager & Son, Danville, Ill., $79,341; Fred. Deiter, Joplin, Mo., $98,032; Globe Construction Co., St. Louis, $81,929; J. F. Schmidt Bros. Co., Chicago, $87,800; Cassity Bros., Columbia, Mo., $81,-081.

ST. JOSEPH, MO.—The Webster Full-Expansion Rotary Engine Co., 520 Francis St., will erect a 10 to 12-story office building at a cost of $150,000. Lynch & Cornelius, Commercial Bldg., St. Louis, is Arch.

JEFFERSON BARRACKS, MO.—We are officially advised that bids were received by Capt. O. W. Bell, Q. M., for constructing a double set of H. C. Sergeants' quarters, including plumbing, electric wiring and lighting fixtures. The bids have been rejected and the work will be readvertised.

COLLEGE STATION, TEX.—It is stated that J. S. Harrison, Waco, Tex., was the lowest bidder, at $54,500, for the erection of an Enginering Building at the Agricultural and Mechanical College, College Station.

PUEBLO, COLO.—The Board of Commissioners of Pueblo County have let contract to FRANK TAYLOR, of this city, for the erection of a court-house. Estimated cost, $400,000. A. T. Stewart is Chn. Albert R. Ross, 16 East 42d St., New York, and George W. Roe, Pueblo, are Arch.

FORT WORDEN (Port Townsend post-office), WASH.—Bids are asked until Nov. 14 by First Lieut. Charles C. Burt, Constr. Q. M., Fort Worden, for constructing at Fort Worden two double sets of non-commissioned officers' quarters and one double set of firemen's quarters, also similar buildings at Fort Casey.

PORTLAND, ORE.—Carrere & Hastings, Archs., Fifth Ave., and 26th St., New York, N. Y., advise us that they have completed plans for a new city hall at Portland, to replace the structure which was burned last January. The estimated cost is $750,000. The main facade will be of light granite and will be in the form of a forecourt. An auditorium seating 2,000 persons is to be at the rear of the City Hall proper, and its floor will be on the street level, so that every window may serve as an exit. Marble wainscots and terrazzo flooring are specified for halls and other public spaces. The roof is to be copper. The general quality of construction will conform to that in a high class office building. The work will be under the supervision of the Committee on the New City Hall, appointed by the City Council. Adam T. Leighton is Mayor.

PASADENA, CAL.—The F. O. ENGSTRUM CO., 451 Colyton Ave., Los Angeles, has the general contract to construct a church for the First Church of Christ (Scientists), Pasadena, at $125,000.

SAN FRANCISCO, CAL.—The Quartermaster-General of the Marine Corps, Washington, D. C., will award to RICHARD McCANN San Francisco, Cal., contract for the construction of marine barracks and officers' quarters at the Naval Training Station, Yerba Buena, San Francisco, at a cost of $39,046.

It is reported that plans are being prepared by Righetti & Kuhl, Archs., 1946 Post St., for a 4-story hotel, to be erected at O'Farrell and Polk Sts., estimated to cost $50,000.

Ross & Burgren are engaged on the sketches of the Shiels Estate building, to be erected on the corner of Stockton and O'Farsell Sts. It will be a 6-story and basement Class A structure built of stone and concrete, supported by a steel frame. The upper floors will be divided into loft spaces and the entire building will be occupied by the firm of D. N. & E. Walter. It will cost $175,000.

WINNIPEG, MAN.—George Skinner, proprietor of the Carlton Hotel, Lombard St., has completed plans for the enlargement and improvement of the house, which he intends to carry out at once at a cost of $40,000. Pratt & Ross, Archs., Aikens Bldg., 221 McDermott Ave., have the plans for above work, and will call for bids at once.

WINNIPEG, MAN.—The CARTER-HALLS-ALDINGER CO., of Winnipeg and Chicago, has secured the contract from the Grand Trunk Pacific Ry. Co. to erect depots at the divisional points known as Waterous, Biggar and Wainwright.

## WATER SUPPLY—IRRIGATION.

*(* denotes that this work is advertised in Engineering News.)*

TOPSHAM, ME.—The Trustees of the Brunswick and Topsham Water District awarded the contract on Oct. 19 for the construction of the water extension here to the HANSCOM CONSTRUCTION CO., 1102 Exchange Bldg., Boston, Mass., at about $6,000. Metcalf & Eddy, Boston, are Engrs.

BLANDFORD, MASS.—The Water Commissioners have awarded the contract for a new water supply system to DANIEL A. DOREY, of Natick, Mass., the lowest bidder.

SHERMAN, N. Y.—Bids are asked until Nov. 7, by the village for the construction of a water supply system. E. A. Wilder is Consult. Engr., Fredonia, N. Y. List of approximate quantities are on file at the office of Engineering News, New York.

BROOKLYN, N. Y.—Bids were received on Oct. 28 at the office of John H. O'Brien, Comr. of Water Supply, Gas and Electricity, New York, for extending and improving the high-pressure fire service system at Coney Island, Borough of Brooklyn. The lowest bid received was that of Murphy Bros., of Brooklyn, at $68,379.

The following are the bids opened Oct. 28 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and installing a draining apparatus or fire hydrants in Brooklyn Borough: W. G. Clarke, 438 West 40th St., New York, $31,-500; John Grant, 442 Rogers Ave., Brooklyn, $88,800; John Mead, 215 Montague St., Brooklyn, $38,700; W. C. Hopkins, $38,640.

*PITTSBURG, PA.—Bids are asked by the Department of Public Works until noon, Nov. 23, for furnishing and installing equipment in the extension of the filtration works. Specifications may be obtained on and after Nov. 2 at the office of the Bureau of Filtration, Municipal Hall, Pittsburg. Alexander B. Shepherd is Acting Dir. Pub. Wks.

BALTIMORE, MD.—Bids are asked by the Board of Awards until 11 a. m., Nov. 11 for furnishing all the steel beams, angles, columns, stairways, etc., and erecting same in place, as the beam work of the basement floor, at Mount Royal pumping station. Alfred M. Quick is Water Engr.

BERRYVILLE, VA.—A reservoir with a capacity of 3,000,000 gallons, will be constructed on the side of the Blue Ridge Mountains, the source of Berryville's present water supply. The Town C[illegible] on Oct. 22 awarded the contract [illegible] GLAIZE, of Winchester, for [illegible] of this reservoir. The dam [illegible] started, and the new contra[illegible] completion. Cost, $10,000.

NORFOLK, VA.—T. B. Do[illegible] Water Dept., has recommend[illegible] Control a system providing [illegible] filtration of the city's water [illegible] stated that this natural filtra[illegible] tained by a vacuum system [illegible] air-lift system of wells, [illegible] wells, with well points or [illegible] out from sides, or subsoil [illegible] into system of collecting well[illegible]

BOONE, N. C.—The city co[illegible] construction of a system of [illegible] Benjamin T. Brannocks is In[illegible]

*AUGUSTA, GA.—Bids will b[illegible] the Water-Works Committee [illegible] Council until 4 p. m., Nov. 24, [illegible] ing and erecting at Augusta, a [illegible] gine of 6,000,000 gallons daily [illegible] a steam plant of 450-HP. ca[illegible] Wingfield is City Engr.

TALLAHASSEE, FLA.—The c[illegible] cluded the purchase of the wat[illegible] gas plant, for which $75,000 o[illegible] been voted.

*MERIDIAN, MISS.—Bids are [illegible] 6 p. m., Nov. 24, by the Water [illegible] mission for furnishing all tools [illegible] in the construction of a reinfor[illegible] reservoir and for furnishing [illegible] one 5,000,000-gallon horizontal [illegible] pound crank and fly-wheel pum[illegible] Plans and specifications may be [illegible] office of the Secretary of the [illegible] mission. C. C. Dunn is Pres. [illegible] F. Wilcox is Engr.

DAYTON, OHIO.—The T. J. [illegible] Construction Co., Dayton, submitte[illegible] bid on Oct. 19 for the construc[illegible] of the North Dayton pumping station, at $7,740.

EAST LANSING, MICH.—Bonds for $10,-000 have been authorized by the [illegible] for the construction of a water-works and sewerage system. The pumps will probably be operated by electric power, although construction plans are not yet fully developed.

DETROIT, MICH.—Bids are asked by the Board of Water Commissioners until noon, Nov. 10, for approximately 3,650 tons of c.-i. water pipe, ranging in size from 6-in. to 24-in.; also for 788 water gate valves, ranging in size from 4-in. to 48-in., and for 300 testing boxes, ranging in size from 6-in. to 12-in.

*MUSKEGON, MICH.—The PLATT IRON WORKS, Dayton, Ohio, was awarded the contract by the city on Oct. 26 for a vertical triple-expansion crank and fly wheel engine of the semi-self-contained type with 6,000,000 gallons capacity, at $35,[illegible]. Noted last week.

BURNHEIM, ILL.—HANRAHAN & LINQUIST, 1005 Chamber of Commerce Bldg., Chicago, Ill., have been awarded the contract at $9,200 for laying a system of water mains here. W. B. Ewing is Engr., 1005 Chamber of Commerce Bldg., Chicago.

PEKIN, ILL.—Bids will be received by the Commisioners of the Spring Lake Drainage and Levee District until Nov. 24 for water tube boilers, compound condensing steam engines and centrifugal pumps for pumping plant on Illinois River about 17 miles south of Pekin. The Harmon Engineering Co., 120 Fredonia Ave., Peoria, Engrs.

CHICAGO, ILL.—The PARKER-WASHINGTON CO., Chamber of Commerce Bldg., Chicago, has secured the contract for pump pit, suction well and foundations for the Roseland pumping station engine house at about $46,000. Bids were opened on Oct. 24. John J. Hanberg is Comr. Pub. Wks.

KEWANEE, ILL.—Bids for laying one mile of new water main in the southwest portion of the city were opened on Oct. 20 by the Board of Local Improvements, as follows: B. C. Parkinson & Co., Kewanee, $3,711; Isaac Pearson & Swan Mason, Kewanee, $3,480; F. H. Iglehart, Morgan Park, Ill., $3,899; Kewanee Sanitary Supply Co., $3,928; J. P. Brady, Kewanee, $3,961; J. M. Healey Co., Chicago, $3,949; Granquist & Euard, Kewanee, $4,070; H. D. Hallett, Aurora, Ill., $4,408.

FRANKLIN GROVE, ILL.—B. F. SHEETS & SON, of Oregon, Ill., have secured the contract by the village for laying water mains.

CHICAGO, ILL.—Plans for a high pressure water system have been completed for the district bounded by Chicago Ave., Halsted and Twelfth Sts. Estimated cost, $2,500,-000. John J. Hanberg is Comr. Pub. Wks.

FORT DODGE, IOWA.—Bids are asked until 2 p. m., Nov. 12, by the Oakland Cemetery Association, B. R. Canfield, Secy., for the construction of 2,500-gallon steel tank on a 75-ft. tower.

SPIRIT LAKE, IOWA.—The citizens have voted in favor of issuing $22,000 of bonds for water-works extension.

EAST GRAND FORKS, MINN.—P. R. McDONNELL, of Duluth, Minn., was awarded the contract on Oct. 22 by the Council for mains, tank, tower, pump pit and intake pipe for the water-works, at $27,400. C. P. Zimmerman is City Clk.

WALTHILL, NEB.—The village is considering the installation of a combined water and electric light system. Estimates on the cost of such a plant will soon be asked.

FARGO, N. DAK.—Bids are asked by N. C. Morgan, City Audr., until 5 p. m., Nov. 12, for furnishing all materials for, and the construction of a 6-in. water main on Eighth Ave., North, extending from Seventh St., North, to Tenth St., North, in Water Main District No. 2. Plans and specifications may be seen at the office of the City Auditor.

BELLE FOURCHE, S. DAK.—The Secretary of the Interior has awarded the contract to J. E. HILTON, Vale, S. Dak., for the construction of a portion of the lateral system of the Belle Fourche irrigation project, involving the excavation of about 3[illegible],000 cu. yds. of material, at $17,843.

SHERMAN, TEX.—The city has awarded the contract to the TEXAS & LOUISIANA WELL DRILLING CO., at $3.20 per ft. for drilling two 6-in. wells, 800 ft. deep. Two deep-well pumps will be installed.

HOUSTON, TEX.—The city has voted $100,000 of bonds for the extension of water mains. H. B. Rice is Mayor.

BROWNWOOD, TEX.—The city has awarded contract to the FOOS GAS ENGINE CO., Springfield, Ohio, for furnishing a gas-burning engine to be installed at new pumping station of municipal water-works. Cost, about $15,000.

VICTORIA, TEX.—Jules Leffland, of Victoria, has prepared plans for the construction of a reinforced-concrete reservoir; depth, 15 ft.; diameter, 100 ft.; capacity, 882,000 gallons. Estimated cost, $5,000. Bids have been received on excavation, 500 bbls. of cement and other materials required in construction. William Wheeler, Supt. W.-Wks. and Sewers, will supervise construction.

TEAGUE, TEX.—The N. S. SHERMAN MACHINE & IRON WORKS, of Oklahoma City, Okla., has been awarded the contract at $50,000 for the construction of water-works system with a daily capacity of 1,000,000 gallons; 75,000-gallon reservoir, 300,000,000 gallons; 75,000-gallon standard water tower 100 ft. high. The equipment includes two 85-HP. engines, belt-driven; two single-acting triplex pumps, 8 x 10 ins. J. W. Maxcy, C. E., Binz Bldg., Houston, Tex., is Engr.-in-Charge.

OKLAHOMA CITY, OKLA.—The city has awarded the contract to the KELFER CONTRACTING CO., of Oklahoma City, at $19,714, for constructing four filter basins.

MUSKOGEE, OKLA.—The city will extend the water-works, including the construction of a pump station and low-service pump and high-duty pump, together with 4½ miles of 24-in. main, several miles of 12 and 8-in. main. Plans and specifications will soon be completed. T. H. Martin is Mayor.

ABERDEEN, WASH.—The Superintendent of Public Works has recommended the construction of a reservoir and extension of mains for the improvement of the water service. Estimated cost, $38,200.

SAN DIEGO, CAL.—Bids are asked until 10 a. m., Nov. 12, by the Board of Public Works, F. H. Dixon, Clk., for constructing a reservoir. Estimated cost, $121,000.

SACRAMENTO, CAL.—Judge J. A. Waymire, of Alameda, Cal., is interested in a prospect for supplying the bay cities and intermediate points, including Sacramento, with water from Lake Tahoe, the Truckee River and the North Fork of the American River. It is proposed to divert water from the Truckee River four miles below Lake Tahoe, carrying it in a concrete canal to Squaw Creek Valley, thence tunneling 5½ miles through the mountains to Soda Springs, at the head of the American River, thence by canal and pipe to the north fork of the American and to Dutch Ravine, near Newcastle, from which point the water would be piped to the bay, a distance of 120 miles. It is estimated that 300,000 HP. of electrical energy could be generated along the route. Estimated cost of entire work, $20,000,000.

SAN FRANCISCO, CAL.—Bids are asked by the Board of Public Works until Nov. 18 for pumps and turbines for the fire protection system and for the salt-water pumping stations. Estimated cost, $257,000. Marsden Manson is City Engr.

HAMILTON, ONT.—The contract for the equipment of the Beach pumping station has been awarded to the CANADIAN WESTINGHOUSE CO., Ltd., Sovereign Bank Bldg., and the JOHN McDOUGALL CO., Montreal, Que., at $20,148. The motors and pumps will have a speed of 800 r. p. m.

HAMILTON, ONT.—See item under Light and Power Plants.

## SEWERAGE.

*(* denotes that this work is advertised in Engineering News.)*

ROCHESTER, N. Y.—Edwin H. Fisher, City Engr., is preparing plans for the construction of a vitrified pipe sewer in Spruce St., from Hazel to Slocum Sts. Bids will be asked by the Board of Contract and Supply.

WHITESTONE (L. I.), N. Y.—The Board of Estimate and Apportionment has adopted a resolution approving the plan and specifications for the construction of a temporary sewer in 14th Ave., between 27th and 14th Sts., Whitestone. The sewer is to be 1,000 ft. long. Estimated cost, $8,500.

LONG ISLAND CITY (L. I.), N. Y.—Bids were received as follows on Oct. 27 by Lawrence Gresser, Pres. Boro. of Queens, for the construction of a sewer and appurtenances in 17th Ave. from Wilson Ave. to Jackson Ave. and in Vandeventer Ave. from 17th Ave. to 18th Ave., First Ward: Richard P. Green, $16,001; Gabriel Hill, $21,231; Peace Bros., $13,438; Bart Dunn, $38,036; H. J. Mullen, $13,454; Long Island Contracting Co., $13,069; Gore Engineering & Contracting Co., 206 Broadway, New York, $16,149.

ALTOONA, PA.—Bids will be received by the Board of Public Works until 8 a. m., Nov. 9, for the construction of vitrified clay pipe sewer as follows: The Crawford Ave. sewer, between 15th and 16th Sts.; in 16th St., between Crawford Ave. and Crawford Alley; in Crawford Alley, between 16th and Jaggard Sts.; in Jaggard St., between Crawford Alley and First Ave., a distance of about 1,340 ft.; an 8-in. pipe sewer with 450 ft. of 6-in. pipe. Specifications may be seen at the office of the City Engineer. J. B. Andrews is Chn. Bd.

BALTIMORE, MD.—The Sewerage Commission has awarded following contracts in connection with the sewerage system: NEW YORK CONTINENTAL JEWELL FILTRATION CO., 15 Broad St., New York, at $506,000 for sewage disposal works at Back River, to be completed in 500 days; METROPOLITAN CONTRACTING CO., H. H. Crane, Pres., 836 Equitable Bldg., Baltimore, at $149,841, for west low-level intercepter, Section 4, southwest Baltimore, 250 days; RYAN & REILLY, 26 South 15th St., Philadelphia, Pa., at $155,202, for force main and Central Ave., to Chase and Durham Sts., 275 days; WARREN F. BRENIZER CO., 229 South Howard St., Baltimore, and 63 R St., N. W., Washington, D. C., at $120,778 for force main, 211 days. The disposal plant work includes seven filter beds, seven sludge tanks, excavation, embankment and underdrains, largest items considered being 31,000 cu. yds. of excavation, 38,000 cu. yds. of concrete masonry, 521,000 ft. of slotted vitrified slabs, 1,300,000 lbs. of reinforcing rods, one meter-house, one control-house and four pump-houses. Bids were opened on Oct. 24. Calvin W. Hendrick is Ch. Engr.

WASHINGTON, D. C.—Contracts for constructing sewers in the District of Columbia have been awarded as follows: Sewers in Congress Heights, to the LAKE STONE CO., at $9,921; in S St. and 14th St., S. E., to the W. F. BRENIZER CONSTRUCTION CO., at $3,352. Asa E. Phillips is Supt. of Sewers.

The Commissioners of the District of Columbia have awarded the contract for furnishing two vertical compound engines for the sewerage disposal plant to the SHEPHERD ENGNEERING CO., Williamsport, Pa., at $5,126.

CHARLESTON, W. VA.—The city has awarded the contract to JAMES FERRY & SONS, Grafton, Pa., at $62,173 for the construction of a sewer system here of brick. W. A. Hogue is City Engr.

BESSEMER, ALA.—New bids will soon be asked for completing the Third Ave. storm sewer.

TUSKAGEE, ALA.—Bids are asked by the city until Nov. 16 for the construction of sanitary sewers, the work including about 3,755 lin. ft. of 8-in. sewer and 1,529 lin. ft. of 6-in. sewer, and all manholes and appurtenances. G. N. Mitcham is Engr.; O. S. Lewis is Mayor.

CLEVELAND, OHIO.—Bids will be received by the Secretary of the Board of Public Service until noon, Nov. 12, for the construction of a sewer in East Twelfth St., from Walnut Ave., N. E., to a point 460 ft. southerly. W. J. Springborn is Pres. Bd.

ZANESVILLE, OHIO.—Bids are asked until noon, Nov. 9, by the Board of Public Service, for constructing a sanitary sewer in a portion of Gilbert Alley, and a storm and sanitary sewer in portions of Granite Alley and Elm Ave. J. T. Hahn is Clk. Bd.

LOCKLAND, OHIO.—Bids are asked by Clifford Troy, Village Clk., until noon, Nov. 9, for the construction of about 1,200 ft. of sanitary sewer with the necessary appurtenances. The sewer is to be of double strength, vitrified pipe, 15 ins. in diameter, laid at a depth ranging from 14 to 34 ft.

CINCINNATI, OHIO.—THE WILLIAM HEFFERON CONSTRUCTION CO., 810 Neave Bldg., was awarded the contract on Oct. 22 by the Board of Public Service for constructing sewers in Fisher Ave., Collins Ave. and Powers St., at $32,667.

FORT WAYNE, IND.—Bids will be received by the Board of Public Works until 7.30 p. m., Nov. 12, for the construction of vitrified clay pipe sewers. H. W. Becker is Clk. Bd.

SOUTH BEND, IND.—Bids are asked until Nov. 10, by the Board of Public Works for constructing a sewer in Jefferson and Hine Sts.

MARSHALL, ILL.—Bids are asked until Nov. 12 by the Board of Local Improvements for constructing about two miles of reinforced-concrete and vitrified-pipe sewers. Paige & Stock are Engrs., 116 South Sixth St., Terre Haute, Ind.

The MERCANTILE BRIDGE & CONCRETE TILE CO., Paris, Ill., has been awarded the contract at $17,000 for installing a sanitary sewer system here.

PROPHETSTOWN, ILL.—The city will construct a sewer in Locust St. Estimated cost, about $7,000.

SPRINGFIELD, ILL.—The HENRY NELCH CONTRACTING CO. has been awarded the contract by the city at following prices for constructing the south end sewer: Sewer, 4 ft. deep, $3.35 per lin. ft.; 2-in. outlet, 50 cts.; manholes, $30 each. Total cost of improvement, $20,000.

DECATUR, ILL.—GEORGE B. TUTTLE has secured the contract at $5,825, for constructing two sewers.

OCONOMOWOC, WIS.—The Board of Public Works has awarded the contract to C. J. CRILLEY, Milwaukee, Wis., at $22,399, for the construction of a sewage disposal plant, sanitary sewers and appurtenances. Elsworth Olson is City Clk.

MONROE, WIS.—The O'FARRELL CONSTRUCTION CO., Dubuque, Iowa, has secured the contract, at $3,528, for constructing 5,600 ft. of 15-in. sewer.

BELOIT, WIS.—The Board of Public Works, on Oct. 26, opened bids for lateral sewers in Euclid and Portland Aves. The bids follow: G. Maffioli, $7.50 for each surface; Newton & Zimmerman, $8.40. R. R. Caldwell is City Engr.

FORT DODGE, IOWA.—Bids are asked until 5 p. m., Nov. 16, by the City Clerk, for constructing sanitary sewers in 15th St., Fourth Ave., South Seventh Ave., South, 19th St. and in Tenth St., in West Fort Dodge.

BURLINGTON, IOWA.—Bids are asked by the City Clerk until 4 p. m., Nov. 7, for the construction of a vitrified pipe sewer in Washington St., from Central Ave. West to the center of Marshall St., size of pipe to be 15 ins. in diameter. J. F. Winters is City Engr.

FARGO, N. DAK.—Bids are asked by N. C. Morgan, City Audr., until 5 p. m., Nov. 12, for the construction of 12-in. lateral sewers in several streets.

ST. JOSEPH, MO.—The Board of Public Works has decided to expend $250,000 in constructing main sewers this winter.

ST. LOUIS, MO.—The Board of Public Improvements on Oct. 23 approved ordinances for the construction of small sewers in the Harlem Creek and Cora Ave. sewer districts, aggregating $135,000. All except $10,000 of the work is to be done in the Harlem Creek district.

HOUSTON, TEX.—The city has voted $225,000 of bonds for the construction of sanitary sewers and $225,000 for the construction of storm sewers. H. B. Rice is Mayor.

SANTA BARBARA, CAL.—The City Engineer is preparing plans for the construction of a sewer system in the eastern portion of the city.

LOS ANGELES, CAL.—The following are the lowest bidders for the construction of sewers in various streets: David Joy, sewer in Moneta Ave., from Vernon Ave. to 36th Pl., and other street, $8,850; A. H. Calkins & Co., sewer in Moneta Ave., from a point 195 ft. south of 58th St. to Vernon St. and other streets, $9,718; same, sewer in Los Angeles St., from First to Arcadia Sts., $3,021. Homer Hamlin is City Engr.

SALT LAKE CITY, UTAH.—Bids are asked by the Board of Public Works until 8 p. m., Nov. 6, for constructing sewer extensions Nos. 211 and 213. Louis C. Kelsey is City Engr.

## GARBAGE DISPOSAL.

NEW YORK, N. Y.—Street Cleaning.—See item under Buildings.

COLUMBUS, OHIO.—Bids will be received by the Board of Public Service until Nov. 16 for furnishing machinery and equipment for the reduction of garbage. I. S. Osborn is Engr.-in-Charge.

EVANSVILLE, IND.—Bids are asked by the Board of Public Works until Nov. 14, for sweeping and cleaning the brick, asphalt and block streets for the year 1909. W. F. Wunderlick is City Clk.

## STREETS AND ROADS.

*(* denotes that this work is advertised in Engineering News.)*

SALEM, N. H.—Bids are asked by A. W. Dean, State Engr., Concord, N. H., until Nov. 7 for a macadam road here.

FORT ANDREWS (BOSTON POST-OFFICE), MASS.—The contract for the construction of roads and walks at Fort Andrews has been awarded to FRED A. ELDREDGE, of Westerly, R. I., at $19,435.

HARTFORD, CONN.—Bids for the construction of state road work will be received at the office of the State Highway Commissioner, Capitol, until 2 p. m., Nov. 7, as follows: Town of South Windsor, 13,890 lin. ft. macadam, including three 24-in., one 15-in., two 20-in., one 18-in., two 6-in., and two 12-in. tile culverts on the main road to Springfield; town of Orange, 17,550 lin. ft. macadam, including four 12-in., one 18-in., one 15-in., and five 24-in. tile culverts on the Derby turnpike; town of East Granby, 3,500 lin. ft. gravel-telford and one 15-in. tile culvert, on the main road to Suffield; town of Nauatuck, 3,700 lin. ft. macadam and one 12-in. tile culvert on the Waterbury road; town of Woodbridge, 1,330 lin. ft. macadam on the Seymour road.

NEW YORK, N. Y.—Bids are asked by the Park Board until 3 p. m., Nov. 12, for paving with asphalt tiles the ends of the parks in Broadway, between 80th and 95th Sts.; for paving with asphalt tiles the ends of the parks in Broadway, between 95th and 110th Sts., Borough of Manhattan.; for excavating and disposing of earth or other materials, and furnishing in place thereof good garden mold in the parks on Broadway, between 73d and 86th Sts., Borough of Manhattan. Henry Smith is Pres. Bd.

ROCHESTER, N. Y.—WHITMORE, RANBER & VICINUS have been awarded the contract at $8,028 for constructing asphalt pavement on Westminster Road.

BROOKLYN, N. Y.—Bids will be received until Nov. 11 by Bird S. Coler, Boro. Pres., for regulating and repaving with sheet asphalt on Arlington, Classon, Franklin, Marcy and Underhill Aves., Fleet and St. Felix Sts., Lincoln Pl. and Prospect Pl., 14,850 sq. yds.; with granite on Grand and Keap Sts., about 13,890 sq. yds.; regulating, grading, curbing and laying cement sidewalks on portions of East Eighth, East 23d, East 29th and 47th Sts., about 22,940 sq. ft.

LONG BEACH (L. I.), N. Y.—William H. Reynolds, Pres. Estate of Long Beach, awarded the contract on Oct. 31, with M. C. MADISON for laying sidewalks, curbs, and parkings in the central portion of Long Beach, comprising a section of about 7,000 lots. The contract embraces laying about 65 miles of concrete walks and curbing. This work, together with the sewers for this section, will cost about $700,000 and will be completed by June 15, 1909.

NEW BRIGHTON (S. I.), N. Y.—Bids were received as follows on Oct. 27 by George Cromwell, Pres. Boro. of Richmond, for (a) furnishing and delivering 9,000 tons of 1½-in. and ¾-in. broken stone and screenings of trap rock or Staten Island syenite at such points and in such quantities from time to time as the Superintendent of Highways may direct; (b) furnishing and delivering 7,000 tons of 2½-in. and ¾-in. broken stone and screenings of trap rock or Staten Island syenite under same conditions; (c) furnishing and delivering 4,750 tons of 1½-in. and ¾-in. broken stone and screenings of trap rock or Staten Island syenite under same conditions: Joseph Johnson's Sons, 193 Broadway, West New Brighton, (a) $1.79; (b) $1.78; (c) $1.88; Clinton Point Stone Co., 115 Broadway, New York, (a) $1.74; (b) $1.74; (c) $1.84; Manhattan Trap Rock Co., 30 Church St., New York, (a) $1.80; (b) $1.85; (c) $1.95; Quinroy Construction Co., John St., Port Richmond, (a) $1.50; (b) $1.40; (c) $2.00; Joseph A. Boyce, (a) $1.89; (b) $1.89; (c) $1.89; Thomas Carlin, West New Brighton, (b) $2; (c) $1.85.

NEW YORK, N. Y.—Bids were opened as follows on Oct. 29 by Louis F. Haffen, Pres. Boro. of the Bronx, for (a) paving with asphalt blocks on a concrete foundation the roadway of Morris Park Ave., between West Farms Road and Bear Swamp Road, and resetting curbstones where required; (b) paving with asphalt blocks on a concrete foundation the roadway of Morris Ave., from Tremont Ave. to Burnside Ave., setting curb where necessary; (c) repaving with asphalt blocks on a concrete foundation, Teller Ave., from Park Ave. to East 164th St., setting curbs where necessary: Barber Asphalt Paving Co., 50 Church St., New York, (a) $80,782; (b) $10,165; (c) $8,934. Continental Asphalt Paving Co., 79 Wall St., New York, (a) $94,874; (b) $9,907; (c) $8,561. Asphalt Construction Co., Madison Ave. and 137th St., New York, (a) $95,858; (b) $9,683. Asphalt Paving Co., (c) $8,476. Hastings Pavement Co., 25 Broad St., New York, (a) $92,847; (b) $9,938; (c) $8,476.

Bids were received as follows for (a) regulating, grading, setting curbstones, flagging sidewalks, laying crosswalks, building approaches and placing fences in Bryant Ave., from Lafayette Ave. to the New York, New Haven & Hartford R. R.; (b) regulating, grading, setting curbstones, flagging sidewalks, laying crosswalks, building approaches and placing fences in the following streets: Morris Ave. from Field Place to Fordham Road; West 142d St., from Summit Ave. to Ogden Ave: D. W. Horrang, (a) $10,834; Frank Falk, 2371 Old Broadway, New York, (a) $13,706; Haggerty Contracting Co., 217 West 125th St., New York, (a) $19,406; (b) $5,165; Frank Del Balso, (a) $12,562; (b) $5,678; C. C. Yoorycees, (b) $6,421; C. C. Duffy, (b) $6,433; P. J. Kane, (b) $6,244.

Bids were also received as follows for repaving with asphalt blocks on a concrete foundation Webster Ave., between East 164th St. and East 171st St., setting curbs where necessary: Atlanta Contracting Co., 230 East 42d St., New York, $72,984 and $49,390. Asphalt Construction Co., Madison Ave. and 137th St., New York, $71,308 and $46,462.

LONG ISLAND CITY (L. I.), N. Y.—Bids were received as follows on Oct. 27 by Lawrence Gresser, Pres. Boro. of Queens, for (a) regulating, grading, curbing and laying bluestone sidewalks on William St. from Paystar Ave. to Beebe Ave., First Ward; (b) regulating, grading, concrete curbing and laying bluestone sidewalks and crosswalks on Academy St., from Grand Ave. to Vandewater Ave., First Ward; (c) regulating, grading, concrete curbing and laying bluestone sidewalks and crosswalks, on Vandewater Ave., from Tenth Ave. to Old Bowery Bay, First Ward; (d) regulating, grading, concrete curbing and laying bluestone sidewalks and crosswalks on 18th St., from Flushing Ave. to Wilson Ave., First Ward; (e) regulating and grading 17th Ave., from Jackson Ave. to Flushing Ave., First Ward; (f) regulating, grading, curbing, recurbing, flagging, reflagging, laying crosswalks and paving with granite block pavements on a sand foundation the roadway of Tenth Ave. from Wintrip Ave. to Riker Ave., First Ward: Long Island Contracting & Supply Co., (a) $19,481; (c) $17,375; (d) $8,309; (e) $17,280; (f) $10,567. Peace Bros., (a) $7,854; (b) $11,999; (c) $16,342; (d) $7,641; (e) $13,950; (f) $11,888. H. P. George, (a) $11,562; (b) $11,881; (c) $17,071; (d) $7,981; (e) $17,859; (f) $11,731. Astoria Contracting Co., (a) $7,802; (b) $1,944; (c) $15,560; (d) $8,241; (e) $19,950; (f) $11,148. R. P. Green, (a) $8,585; (e) $22,050. H. J. Mullen, Fulton St., Brooklyn, (a) $10,781; (b) $12,779; (d) $7,217; (e) $14,885; (f) $16,026. BART DUNN, 444 East 68th St., New York, (a) $7,355 (awarded contract); (b) $12,700; (c) $17,239; (d) $9,145; (e) $19,141; (f) $13,107. H. F. Quinn & Son, (b) informal. Thomas Crimmins, 444 East 69th St., New York, (b) $15,845; (c) $19,550; (e) $19,875; (f) $13,540. R. E. HENNINGHAM, (b) $10,992; (c) $15,250; (d) $7,399; (e) $13,500 (awarded contract); (f) $14,400. NATIONAL CEMENT & CONSTRUCTION CO., 99 Nassau St., New York, (b) $9,450 (awarded contract). Thomas F. Touhy, (b) $12,333; (c) $17,630; (d) $8,037; (e) $17,925. B. E. Contracting Co., (b) $13,528. D. W. Moran, (c) $17,245; (d) $8,225; (e) $17,700; (f) $12,359. John Hughes (c) $16,677; (d) $8,415. Dennis McCarthy, (c) $17,995. Troisi & Cavaluzzo, (c) $14,183; (d) $7,559; (e) $15,457. John Young, (c) $18,930; (f) $13,285. William Hicks, (d) $7,540; (f) $12,410. John H. Hogan, (d) $8,678; (f) $11,694.

Bids were also received for paving with asphalt pavement on a concrete foundation the roadway of Elm St., from Hopkins Ave. to Ely Ave., First Ward: CONTINENTAL ASPHALT PAVING CO., 79 Wall St., New York, $9,146; Hastings Pavement Co., $9,147. Barber Asphalt Paving Co., $9,257.

BROOKLYN, N. Y.—Bids were received as follows on Oct. 21 by Bird S. Coler, Pres. Boro. of Brooklyn, for (a) regulating and repaving with sheet asphalt, Class B, on a concrete foundation Marcy Ave., from Middleton St. to Flushing Ave. and all work incidental thereto; (b) regulating and repaving with sheet asphalt, Class B, on a concrete foundation, Underhill Ave., from St. Marks Ave. to Sterling Place, and all work incidental thereto; (c) regulating and repaving with sheet asphalt, Class B, on a grouted stone block foundation, Classon Ave., from Fulton St. to Bergen St., and all work incidental thereto; (d) regulating and repaving with sheet asphalt, Class B, on a concrete foundation, Franklin Ave., and all work incidental thereto; (e) regulating and repaving with sheet asphalt, Class B, on a concrete foundation, Fleet St., from DeKalb Ave. to Hudson Ave., and all work incidental thereto; (f) regulating and repaving with sheet asphalt, Class B, on a grouted stone foundation, St. Felix St., from Lafayette Ave. to Hanson Place, and all work incidental thereto; (g) regulating and repaving with sheet asphalt, Class B, on a concrete foundation South Oxford St., from Hanson Place to Atlantic Ave., and all work incidental thereto; (h) regulating and repaving with sheet asphalt, Class B, on a

concrete foundation, Prospect Place, from Carlton Ave. to Underhill Ave., and all work incidental thereto; (i) regulating and repaving with sheet asphalt, Class B, on a concrete foundation, Lincoln Place, from Brooklyn Ave. to Albany Ave., and all work incidental thereto: Barber Asphalt Paving Co., 30 Church St., (a) $7,818; (b) $12,503; (c) $17,873; (d) $8,322; (e) $7,044; (f) $5,428; (g) $10,695; (h) $18,564; (i) $10,311. Cranford Co., 18 Ninth St., Brooklyn, (a) $8,082; (b) $12,613; (c) $17,262; (d) $8,533; (e) $7,233; (f) $5,200; (g) $10,309; (h) $17,444; (i) $10,763. Standard Asphalt Rubber Co., 288 Broadway, New York, (e) $5,961; (f) $4,105; (g) $8,370; (h) $14,403; (i) $8,140.

BROOKLYN, N. Y.—Bids are asked until 11 a. m., Nov. 18, by Bird S. Coler, Boro. Pres., for regulating, grading, curbing and laying sidewalks, and regulating and paving with asphalt pavement on a concrete foundation the roadways of various streets.

PITTSBURG, PA.—NEELAND & DALY were awarded the contract on Oct. 24 for macadamizing Freeport Road, No. 5, about two miles long, by the County Commissioners at $27,896.

PHILIPSBURG, PA.—The contract for constructing a section of state road in Decatur Township, Clearfield County, from Point Lookout bridge to Mock's cemetery, near Blue Ball, has been awarded to the CONESTOGA CONSTRUCTION CO. at $38,000. Work will soon begin.

BALTIMORE, MD.—James C. Cremen, Chappell and Carey Sts., has submitted the lowest bid at $5,943 for improving Glen Ave., from Park Heights Ave. to the Registertown road. B. T. Fendall is City Engr.

WASHINGTON, D. C.—The Engineering Department on Oct. 22 ordered the following repairs to city streets: Resurfacing roadway of New Jersey Ave. N. W., between P St. and Florida Ave. Estimated cost, $14,000; from K St. to New York Ave, $7,400; from N to O St., $3,000.

CHARLESTON, W. VA.—The Board of Affairs has recommended that all bids for street paving be rejected. W. A. Hogue is City Engr.

ANNISTON, ALA.—J. S. CONNIFF & CO., of Anniston, have been awarded the contract at 87¾ cts. per sq. yd. for paving sidewalks. J. D. Hunter is City Engr.

GULFPORT, MISS.—Harrison County has voted $50,000 of bonds for the improvement of roads and bridges.

PASCAGOULA, MISS.—The Mayor and Board of Aldermen on Oct 26 awarded the contract to the SULLIVAN & DAVIS CO., Montgomery, Ala., for constructing concrete curbs and gutters, with necessary sewers in the city, at about $20,000. The principal work to be done at this time includes Krebs Ave., Cedar and Magnolia Sts., a part of Pascagoula St. and Jackson Ave. Other streets will be taken up in the course of the contract.

OPELOUSAS, LA.—Bids will be received until Nov. 18 by M. Halphen, Mayor, for constructing approximately 6,974 ft. of cement sidewalks, 5 ft. wide.

NEW ORLEANS, LA.—The city is considering the paving of Main and North Boulevard. Estimated cost between $20,000 and $25,000. W. J. Hardee is City Engr.

LEXINGTON, KY.—The city has awarded the contract to DES COGNETS & CO., of Lexington, for the construction of cement sidewalks on Ashland Ave. at 42 cts. for curbing and guttering and 12 cts. for paving. P. P. O'Neill is City Engr.

LOUISVILLE, KY.—The Board of Public Works has awarded contracts as follows: To GEORGE W. GOSNELL, Louisville, for paving three alleys with vitrified brick at $1.80 per sq. yd. Total of $4,000. To AMERICAN CONCRETE SIDEWALK CO., Louisville, for sidewalks at 98 cts. per sq. yd. Total, about $6,000. Joseph P. Claybrook is City Engr.

FORT THOMAS, KY.—C. J. HELM, JR., of Fort Thomas, Ky., has been awarded the contract at $6,979 for the construction of roads and walks at Fort Thomas.

CLEVELAND, OHIO.—Bids are asked until 11 a. m., Nov. 14, by the County Commissioners, William F. Black, Clk., for the improvement of Mayfield Road from Warrensville Road easterly to the easterly line of Euclid Township.

CINCINNATI, OHIO.—The County Commissioners on Oct. 29, awarded the contract for the improvement of the Duck Creek Road to the GEPHART-O'MALEY CO., at $41,912. The Surveyor's estimate for the work was $56,129. Other bidders were M. Sullivan & Sons, $41,972; the Robinson Construction Co., $42,668; Francisco & Dawson, $43,949; George Murdock, $44,117; Edward Meier, $44,796; John Ruebel & Bro., $45,049; John Snyder, $45,969; O'Brien & Anderson, $47,965. Fred. Dreihs is Clk. Comrs.

FOLLANSBEE, OHIO.—The contract for the Main St. curbing has been let to JOSEPH ZAGER and CASTO & McCOOMBS at 37 cts. and 34½ per lin. ft. respectively.

MANSFIELD, OHIO.—CARROLL & GRUBER, Caledonia, Ohio, have secured the contract at $17,778, for constructing 3¼ miles of pike road.

FORT WAYNE, IND.—See item under Sewerage.

ELKHART, IND.—Plans have been ordered for the paving of South Main St. with sheet asphalt. Bids will be asked soon.

ROCKFORD, ILL.—The STANDARD PAVING CO., 34 South Clark St., Chicago, Ill., has been awarded the contract by the city at $49,339 for paving on east side and west side.

GENESEO, ILL.—KEYS & McNAMARA, La Salle, Ill., were awarded the contract by the city for paving State St. at $40,000.

WATERLOO, IOWA.—The contract for constructing about ten miles of cement walk here was let on Oct. 26 by the City Council to MISHLER & RYAN, of Waterloo, at 37 3-8 cts. per lin. ft. The next lowest bidder was the Cedar Falls Cement Co., at 38.73 cts. per lin. ft.

HASTINGS, NEB.—The following bids have been received by the city for paving the alley between Second and Third Sts., from Lincoln Ave. to Burlington Ave.: A. J. Van Avery, Kansas City or Des Moines brick, $2.85 per sq. yd., if same can be procured before freezing prevents excavating; curb, 70 cts. per lin. ft., 5 × 20 ins. (3 ft. 6 ins. and over), and 68 cts. for curb 5 × 18 (3 ft. 6 ins. or over). Clarence Young: Flint or Des Moines brick, $2.60 per sq. yd; Purington or Coffeyville, $2.50 per sq. yd.; curb, 70 cts. per lin. ft., 5 × 20 ins.

LINCOLN, NEB.—The following bids have been received by the Paving Committee of the City Council for paving with asphalt (a) C St., (b) Vine St., (c) E St., and with brick (d) 14th St.: Fred. McLaughlin & Bryant, of Waterloo, Iowa, (a), (b) and (c) $2.05 per sq. yd., and $2.15 for Purington brick, and (d) $2.09 for Purington and $1.99 for flint brick; Metropolitan Engineering & Construction Co., (a), (b) and (c) $1.99 or $2 for vitrified brick; Robert Malone, (d) $2.05. William Grant is City Engr.

SPRINGFIELD, MO.—The contract for paving with brick a portion of Benton Ave. was awarded on Oct. 20 to JARRETT CONSTRUCTION CO., of Springfield, at $2.31 per sq. yd.

ST. JOSEPH, MO.—J. H. HARTMAN was awarded the contract on Oct. 27 for grading Sycamore St. from Ninth to 17th Sts., at 21 cts. a cu. yd.

GALVESTON, TEX.—The NORTH AMERICAN DREDGING CO., 15 Park Row, New York, has secured the contract at $18,086 for filling streets and alleys in the western part of the city.

HOUSTON, TEX.—The Harris County Commissioners awarded the contract on Oct. 20 as follows: To the TEXAS GRADING CO., of Houston, at $31,059 for paving five miles of Cedar Bayou road, to HADEN & SMITH, Houston, at $3,250, for paving one-half mile of Lynchburg and Crosby road, and at $4,592 for paving three-quarters of a mile of Reidlin County road. John B. Ashe is County Audr.

TEXAS CITY, TEX.—Bids will be received until Nov. 9 for regrading and ditching about 8,000 ft. of roads at Texas City. John M. Murch is County Audr., Galveston, Tex.

VINITA, OKLA.—Bids are asked by the City Clerk until 6 p. m., Nov. 10 for the construction of about two miles of concrete combined curb and gutter, curb portion 8 in. × 14-in., gutter portion 6-in. × 2 ft.; 12,000 sq. yds. of brick paving upon a 5-in. concrete base; 6,000 cu. yds. street grading; 5,400 sq. yds. oil macadam.

NORTH YAKIMA, WASH.—Bids will be received by the County Commissioners until Nov. 16 for the hauling of crushed rock for the construction of 2,000 ft. of road.

DAYTON, WASH.—No bids have been received by the State Highway Commission for the construction of the road from Dayton to the city cemetery.

SEATTLE, WASH.—R. H. Thomson, City Engr., has submitted the following estimate of the cost of doing the following local improvement work: Taylor Ave. and other streets, paving, $127,500; Western Ave., grading and regrading, $13,300; Norman St. and other streets, planking, $41,000; James St. and other streets, paving, $5,400; Mercer St., grading, $53,500; Lakeside Ave. and other streets, concrete walks, $13,300; Highland Pl. and other streets, concrete walks, $6,810.

WINNIPEG, MAN.—The contract for asphalting Rorie St. from Lombard to Bannatyne, has been awarded to the Engineer of Construction at $7,577.

## MANUFACTURING PLANTS.

*(* denotes that this work is advertised in Engineering News.)*

BREWER (Bangor post-office), ME.—The Pintsch Compressed Gas Co., 2 Rector St., New York, has purchased land adjacent to the tannery of the Britton Leather Co. in Brewer and will begin the erection of a large gas plant immediately. The Pintsch company furnishes gas for railroads. Pipes will be run from Brewer to the passenger yards of the Maine Central R. R. Co. in Bangor.

WEBSTER, MASS.—D. C. HAWLEY & CO., of Worcester, Mass., have been awarded the contract to put in the foundation for the weaving mill of S. Slater & Sons at Webster, Mass. The structure will be 133 × 460 ft., two stories high.

WORCESTER, MASS.—Harry Rosenberg, a contractor and junk dealer of this city, is at the head of a $100,000 project for making horseshoe nails. Plans are being prepared for a 4-story brick building, in which will be the factory, storage plant and general stores, to be erected on Southgate St. Work of constructing the plant is expected to begin about the middle of November. The building will cost $80,000.

MIDDLETOWN, CONN.—Ground has been broken for the factory which is to be erected in Center St. by the Frisbie Motor Co. The company expects to occupy its new building by December.

HARTFORD, CONN.—Geo. B. Allen, Mill Engr., Hartford, is ready for bids for steam heating for the factory of the Terry Steam Turbine Co., Windsor St. The electric work will also be ready for bids soon. The plumbing has been let to EDWARD MAHL. A. L. HILLS is the contractor and the building is ready for the roof. THOMAS MALCOLM has the contract for the carpenter work.

NEW YORK, N.Y.—We are officially advised that D. C. Newman Collins, Consult. Engr., 29 Broadway, has awarded the contract for the reinforced concrete stock house for the Alsens American Portland Cement Co., 45 Broadway, to the TURNER CONSTRUCTION CO., 11 Broadway. The plans and specifications cover the design for cement bins 25 ft. high for holding loose cement, and this work is to be finished before Jan. 1.

BINGHAMTON, N. Y.—S. O. & H. A. Lacey, Kilmer Bldg., have been engaged to prepare plans for iron and brass works which are to be erected on the west side of the city by the Georgian Mfg. Co.

PORT JEFFERSON, N. Y.—The Dyett Sand-Lime Brick Co., incorporated with a capital of $100,000, has purchased six acres of land on the west side of Port Jefferson Harbor and men are at work clearing the property, preparatory to erecting an iron factory and starting the manufacture of sand-lime brick. The factory building will be completed as soon as possible.

SYRACUSE, N. Y.—Russell & King, Archs., Snow Bldg., Syracuse, have prepared plans for a factory to be erected by F. H. Schneider at 631 West Belden Ave. It will be brick veneer, 40 × 62 ft. Mr. Schneider will use the building for the manufacture of ornamental stucco and molding.

WATERFORD, N. Y.—The Kavanaugh Knitting Co. has awarded the contract for the construction of a spinning plant to the B. Y. SMITH CO., of Pawtucket, R. I. The dimensions of the mill are 229 × 110 ft., three stories in height. There will be a cotton storehouse 100 × 400 ft. The new plant is to be erected near the company's present plant on King's Canal.

PASSAIC, N. J.—JOHN W. FERGUSON & CO., Postal Telegraph Bldg., New York, have the general contract for erecting woolen mills at Passaic, N. J., to be constructed for Forstmann & Huffmann Co., requiring 2,000 tons of steel.

NEWARK, N. J.—The Central Stamping Co., 591 Ferry St., will erect a brick manufacturing building at 591 Ferry St. The structure will be two stories high, 28 × 160 ft., and will cost $25,000. Contract has been let to JOHN G. BROWN, Witherspoon Bldg., Philadelphia, Pa.

William Lehman, 738 Broad St., is Arch. for the box and trunk factories to be built in Spring St. by P. Steiger & Co. They will be of mill construction with brick walls. One will be 60 × 125 ft., the other 50 × 80 ft.; both three stories high. The cost is $20,000.

NETCONG, N. J.—William H. Ashley, of Hackettstown, N. J., it is reported, has secured a site here on which he intends erecting a silk mill, the building to be 45 × 180 ft.

CARNEGIE, PA.—The Carnegie Mill & Lumber Co., of this city, has decided to rebuild the planing mill that was destroyed by fire three weeks ago. New machinery and boiler plant will be required, as the equipment contained in the burned mill is a total loss.

OIL CITY, PA.—W. N. KRATZER & CO., 3218 Smallman St., Pittsburg, have secured the contract for building a $100,000 addition to the plant of the Oil City Boiler Works. Work will commence immediately and will be finished next April, when employment will be given to 250 additional boiler makers and machinists. Charles O'Day, of Pittsburg, is a director of the works.

SHARON, PA.—The Petroleum Iron Works Co., of this city, has had plans prepared for the erection of an addition on each side of the plate mill at the plant at Petroleum, Ohio. The additions will each be one story in height, 80 × 150 ft. New equipment and machinery will also be purchased. The addition will be completed by April 1.

OAKMONT, PA.—The Crane Co., of Chicago, Ill., will call for bids at once for the erection of two big plants for the manufacture of brass valves and fittings, on the 30-acre tract in Oakmont, purchased at a cost of $82,500. The plant, including two buildings, 120 × 1,000 ft. each, will cost in the neighborhood of $1,000,000. It is announced that the plant will give employment to 2,000 men. The Pennsylvania R. R. Co. has begun construction of switches to the plant. The site has a frontage of 1,200 ft. on the Allegheny River and extends to the right-of-way of the Allegheny Valley Division of the Pennsylvania R. R. The Borough Council of Oakmont has vacated all the streets running through the property. The Crane Co. is capitalized at $15,000,000.

PHILADELPHIA, PA.—Wilson, Harris & Richards, Archs., Drexel Bldg., have been commissioned to prepare plans for a 4-story addition, 85 × 225 ft., to be built to the soap factory of Fels & Co., at 73d St. and Woodland Ave. It will be constructed of brick, stone and concrete.

William Steele & Sons, 1600 Arch St., are taking estimates on plans for the erection of a $350,000 factory at 20th St. and Lehigh Ave., for the Lincoln Furniture Co.

BALTIMORE, MD.—McLAUGHLIN BROS., 700 East Lexington St., have secured the contract to erect a 4-story brick factory for the Gandy Belting Co. at King St. and Fremont Ave., to cost $25,000. W. Kennedy Cromwell is Pres.

CUMBERLAND, MD.—Officials of the Cambria Steel Co., Arcade Bldg., Philadelphia and Johnstown, Pa., have been here looking over various available sites suitable for the erection of a rolling mill. It is stated that terms have been reached for the purchase of the tract of ground adjoining the N. & G. Taylor plant here, and that plans will be prepared at once for the erection of a plant that will employ about 500 men. Charles S. Price, Johnstown, Pa., is Gen. Mgr. of the company.

NORFOLK, VA.—The contract for installing laundry equipment in the naval hospital at Norfolk, Va., has been awarded to the TROY LAUNDRY MACHINERY CO., of Troy, N. Y., at $3,372.

CAMERON, N. C.—The Regal Hosiery Mills Co., of Cameron, N. C., has been incorporated with a capital stock of $25,000, and of that amount there has been $5,000 paid in for the preliminary work for installation. The company will establish a modern plant for the production of knit goods, and is planning to have an electric light and power plant in connection. The incorporators are Dunn Bros., Charles C. Jones and R. D. Jones.

CALHOUN FALLS, S. C. ... been let for the machine... Mills, of Calhoun Falls, S. ... CO., of Hopedale, Mass. ... loom contract; GENERAL ... of Schenectady, N. Y., the ... contract; ALLIS-CHALM... waukee, Wis., the engine ... generator contract; KI... SHOP, of Lowell, Mass., ... ery contract; WHITIN MA... of Whitinsville, Mass., ... drawing and spinning fr... contracts are being filled. ... LIVAN BUILDING CO., of ... has the contract for the m... main structure is three ... ft., of brick construction, ... $80,000. A warehouse con... ft. of floor space has been ... of $9,000. Thirty-five cotta... have been built and 15 mo... The company will begin m... 16,380 spindles and 400 lo... to add 10,000 spindles and ... year.

NEW DECATUR, ALA.—T... nice & Roofing Co., L. W... will erect a 3-story brick a... building. It will be of m... 135 × 135 ft., and will cost ... were prepared by W. R. Joh... catur. Cost of additional m... installed has not been d... company will manufacture co... metal window and awnings, ... etc.

ENSLEY, ALA.—The Cot... Works Co. contemplates build... Ensley, Ala., to cost about ... location for the plant has no... lected nor have plans been p... company, which will be con... Walker and other local men.

TUPELO, MISS.—The man... Tupelo Cotton Mills is planni... of additions and the installation ... chinery. The company is arra... crease of capital by issuing pr... to the amount of $110,000. ... 8,500 spindles and 300 looms, ... tricity, and manufacturing sh... etc.

CHATTANOOGA, TENN.—Th... Can Co., present address, Box 1... nooga, Tenn., has purchased ... erect factory to manufacture ... cans, in Ridgedale, a suburb. ... Pres. and Mgr.; F. B. Schultz, ... Treas. The main factory buildi... 50 × 125 ft.; warehouse, 50 ... wood, with corrugated iron sh... position roof. Cost, about $2... machinery, $15,000; daily capa... cans first season. The archite... been selected.

GARY, IND.—The Indiana Steel Co., Gary, Ind., is asking for bids on the erection of the third and fourth units of its open-hearth plant, each unit to contain 14 open-hearth furnaces. Bids are asked also for 140 gas producers for these furnaces. The company asks for bids on twelve gas producers for heating furnaces for the merchant mill and three gas producers for a 25-ton daily capacity steel casting plant.

CHICAGO, ILL.—G. P. & J. W. O'CONNOR, Security Bldg., have secured the contract to erect a $70,000 manufacturing plant for Bauer & Black at 283 25th St. to be of steel and concrete. Holabird & Roche, Monadnock Bldg., are Archs.

ST. CLOUD, MINN.—See item under Light and Power Plants.

ST. PAUL, MINN.—A rendering and hide plant is to be erected here by the butchers of the Twin Cities, it is stated. About $250,000 is to be expended. The Master Butchers' Association is interested.

ST. JOSEPH, MO.—The Webster Full-Expansion Rotary Engine Co., Geo. Lamont Webster, Pres., 520 Francis St., recently incorporated with $100,000 capital stock, will establish general machine shop and foundry. The company will erect an office building and factory. The office building is to be fireproof, of Corinthian architecture, ten to twelve stories. Cost, $150,000. Factory, ordinary mill construction, 300 × 500 ft. Cost, $50,000. Lynch & Cornelius, Commercial Bldg., St. Joseph, are Archs. Thomas Flanagan is Engr.-in-Charge. They will receive proposals for machinery about Dec. 15.

HELENA, ARK.—The Helena Woodenware Co. will expend about $30,000 for additions to its plant and machinery.

EVERETT, WASH.—It has been announced by Capt. P. Y. Dundon, Mgr. of the Puget Timber Preserving Co., whose plant at Everett was burned recently, causing a loss of $100,000, that the company will commence rebuilding at once. The new plant will have the same capacity as the old, but will have improvements.

VANCOUVER, WASH.—The Lester Hydraulic Ram & Irrigation Co. are planning to erect a plant in this city and manufacture the Lester Hydraulic ram. These rams are made in various sizes. They are capable of delivering from 10 to 5,000 gallons of water per minute to heights of 100 ft.

FRESNO, CAL.—It is stated that plans are being prepared for a car house and repair shop to be erected here by the Fresno Traction Co. A. G. Wishon is Vice-Pres. and Gen. Mgr., Fresno.

POMONA, CAL.—The Pomona Mfg. Co. will double the capacity of its plant, the new space to be used principally for the manufacture of a gasoline motor traction engine adaptable for farm use. The construction and machine departments will be extended and the foundry will be moved to another section of the property.

FORT FRANCES, ONT.—The site for the Canadian Northern Ry. Co.'s roundhouse has been laid out and the work of building the necessary equipment for the protection of engines during cold weather will be com-

menced at ... The FORT FRANCES LUMBER ... has the contract for furnishing the material. A. Shields, Winnipeg, is Master Mechanic.

FORT WILLIAM, ONT.—JAMES STEWART & Co. ... have secured the contract from the Grand Trunk Pacific R. R. Terminals Co. for the erection of a 4,000,000-bushel grain elevator here.

WINNIPEG, MAN.—The Empire Meter & Engine Co. ... Canada, has secured a charter from the Manitoba Government and a site 1½ ... extent has been purchased on West ... Ave., adjoining the premises of the ... Wire & Fence Co. Among the incorporators are George L. Rice, Chicago; George ... Chicago; Fred J. Darch, London, Ont.; George Goodfellow, Chicago. Plans for ... story and basement factory building ... ing prepared by W. W. Blaire, Archt., ... Bank Bldg., Winnipeg, and an initial ... penditure of $125,000 will be made for ... ding and plant. W. W. ... Arch., Northern Bank Bldg., has plans ... a factory plant, consisting of wire mill ... two other factory buildings, each 44 ... ft.; a pattern warehouse and a power ... the whole to cost $200,000 and to be located ... west of the C. P. R. shops. Bids are to be called for portions of the work. Concrete blocks will be used.

The contract for the erection of the Grand Trunk Pacific Ry. Co.'s locomotive and car shops which is awarded to THOMAS KELLY & SONS, of this city, will involve an expenditure of about $500,000. The proposed locomotive shops will be 823 x 174 ft. in dimensions and will be constructed of brick, steel and concrete. The total expenditure in this district will be $5,000,000. Frank W. Morse, Montreal, Que., is Gen. Mgr.; William Gill, Winnipeg, is Master Mechanic.

## MISCELLANEOUS CONTRACTS.

*(* denotes that this work is advertised in Engineering News.)*

ATHLETIC FIELD EQUIPMENT.—New York, N. Y.—See item under Buildings, Department of Education.

RETAINING WALL.—Westport, Mass.—BEATTIE & WILCOX, Fall River, have contract for building retaining wall at the Narrows Bridge, at $2,479.

DOCK SUPERSTRUCTURE.—Erie, Pa.—Bids are asked by the Dock Commissioner until Nov. 21 for building superstructure on the public dock extension.

DRAIN.—Clarion, Iowa.—Bids are asked until 2 p. m., Nov. 9, by E. M. Callender, County Audr., Clarion, for construction of drain No. 33, in Lincoln Township.

DITCH.—Bluffton, Ind.—FRANK FISHBAUGH, Huntington, Ind., has been awarded contract for building the Peter McAfee tile ditch, 14,000 ft. in length, at $3,740.

DITCH.—Peru, Ind.—Bids will be received until Nov. 6 by David Kercher, Comr. of Drainage, at the law office of Antrim & McClintic, Peru, for constructing a ditch and branches in Perry Township.

DRAINAGE.—Barstow, Tex.—Bids are asked by the Drainage District Commissioners, Ward County, until 9 a. m., Nov. 14, for construction of a drainage system. T. B. Anderson, Chn. Comrs., Barstow.

DITCH.—Walsenburg, Colo.—Bids will be received until Nov. 14 by T. W. Jaycox, State Engr., Denver, for constructing about 2,400 lin. ft. of drainage ditch to divert flood waters from the town of Walsenburg.

SUBWAY.—Pittsburg, Pa.—The Pittsburg Chamber of Commerce, by an almost unanimous vote, has declared in favor of a municipal subway system from the business district to outlying residential territory.

FILLING.—Galveston, Tex.—The City Commissioners have awarded contract to the NORTH AMERICAN DREDGING CO., 13 Park Row, New York, for additional filling work at $18,086, in the western part of the city.

DITCH.—Crookston, Minn.—The contract for constructing ditch No. 73, bids opened Oct. 21, has been awarded to the VALLEY DREDGING CO., of Stephen, Minn., at $9,525. N. A. Hoffard, County Audr. Noted last week.

*GYMNASTIC APPARATUS. — Prescott, Ariz.—Bids are asked until 3:30 p. m., Dec. 4, by Capt. Chas. C. Walcutt, Jr., Q. M., for furnishing and installing bymnastic apparatus in post exchange and gymnasium at Whipple Barracks, Ariz.

FREIGHT ELEVATORS.—Charleston, S. C.—Bids are asked by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a. m., Nov. 21, for furnishing and installing two freight elevators. Wm. M. Smith, Act. Ch. Bureau.

EMBANKMENTS.—Cincinnati, Ohio.—Bids will be received until Nov. 20 by the County Commissioners at Cincinnati, Fred. Drihs, Clk., for constructing embankments on New Richmond Pike at Four, Five and Eight Mile Creeks, Anderson Township.

VACUUM CLEANING.—Cleveland, Ohio.—Bids will be received at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until Nov. 21 for the installation of a vacuum-cleaning system for the U. S. Post-office.

DITCH.—Marion, Ind.—Bids are asked by D. M. Murphy, Drainage Comr. of the Gilpsie Ditch located in Monroe Township, Grant County, Ind., and Washington Township, Blackford County, Ind., until 2 p. m., Nov. 7, for the construction of this ditch.

MONUMENT.—Gettysburg, Pa.—The Gettysburg Battlefield Memorial Commission has selected the design of W. L. Cottrell, Arch., 44 East 23d St., New York, for a memorial to Pennsylvania soldiers to be erected on the battlefield. Estimated cost, $150,000.

AIR COMPRESSORS.—Washington, D. C.—Bids are asked until 11 a. m., Nov. 21, by the Bureau of Yards and Docks, Navy Dept., for furnishing and installing one 5,000-cu. ft. air compressor and accessories at each of the navy yards, Boston, Mass., and Mare Island, Cal.

DITCH.—Corning, Ark.—Bids are asked until Nov. 14 by the Board of Directors of the Western Clay Drainage District, Chas. W. Jones, Secy., for digging and constructing main ditch and laterals. Estimated quantity, 724,757 cu. yds. J. D. Mitchell, Engr., Grenway, Ark.

LEVEES.—New Orleans, La.—Bids were received by the Mississippi River Commission, Fourth District, 1539 Louisiana Ave., on Oct. 15 for constructing about 461,500 cu. yds. of levee work in Lower Tensas and Pontchartrain Levee districts. Lowest bidder was Mike Hunt, at 21 cts. per cu. yd.

FIRE HOSE, ALARM BOXES.—New York, N. Y.—Bids are asked by the Fire Department until 10.30 a. m., Nov. 16, for furnishing and delivering 5,000 ft. of 1-in. rubber fire hose for use in chemical engines.

Also for furnishing and delivering 75 fire alarm boxes for use in the Boroughs of Brooklyn and Queens.

JETTY.—Boston, Mass.—The contract for building a stone petty at East Dennis, Mass., has been awarded to WM. SEARS, of East Dennis, at $1.90 per ton, for 4,800 tons. Bids were received on Oct. 23 by the State Harbor and Land Commissioners. Frank W. Hodgdon, Ch. Engr.

WHARVES.—Oakland, Cal.—The City Council in committee of the whole on Oct. 21 defeated a resolution introduced by Councilman Jackson recommending a bond issue of $3,600,000 for harbor improvements. This leaves for consideration the recommendation of the board of public works that the issue shall be for $1,150,000.

DOCKS.—Troy, N. Y.—Bids will be received until Nov. 6 by the Board of Contract and Supply for extending a portion of Rensselaer St. by constructing docks and wing docks (with timber or concrete construction), constructing a sewer extension and grading and improving this portion of the street. James M. Riley, Secy.

CONCRETE WALL.—Washington, D. C.—Bids were received by the District Commissioners, H. B. F. Macfarland, Chn., on Oct. 31, for building a concrete retaining wall in Eleventh St., S. E., along the west side of the north approach to the new Ansonia bridge. W. B. Bradley & Co., Richmond, Va., were lowest bidders at $2,986.

AUTOMOBILE TAGS.—Harrisburg, Pa.—The INGRAM-RICHARDSON MFG. CO., of Beaver Falls, Pa., has been awarded the contract for furnishing the Pennsylvania State Highway Department, Harrisburg, with the state automobile tags for the coming year. About 30,000 will be required. The same company has been the successful bidder for the past two years.

TUNNEL.—Jersey City, N. J.—The Hudson & Manhattan R. R. Co. will build an extension to connect the Jersey City station of the Pennsylvania R. R. Co. with the Communipaw station of the Central of New Jersey R. R. Co. Plans have been filed but the work will not be undertaken until the main line from Hoboken to the Hudson Terminal Bldg., New York, is completed. W. G. McAdoo is Pres., 30 Church St., New York.

BUOYS, ETC.—Tompkinsville, N. Y.—Bids are asked by the Light-House Inspector, Tompkinsville, N. Y., until 2. p. m., Nov. 10, for furnishing and delivering buoys and appendages for the light-house establishment during the fiscal year ending June 30, 1909. The articles to be furnished embrace whistling, nun, can, bell, gas, wooden spar, channel and ice buoys, ballast balls, iron sinkers, etc., in accordance with specifications.

DRAIN.—Burlington, Iowa.—Bids are asked until Nov. 14 by the Joint Board of Supervisors of Louisa and Des Moines Counties, at the office of Dan P. Hill, Auditor of Des Moines County, at Burlington, for constructing Sections 1 and 2, requiring 20,000 cu. yds. and 17,460 cu. yds., respectively, and Section 3, requiring 8,200 lin. ft. 18-in. and 2,400 lin. ft. 15-in. tile drain. Harman Engineering Co., 120 Fredonia Ave., Peoria, Ill., Engrs.

DRAINAGE AND BOAT CANAL.—Chicago, Ill.—A canal from Michigan City, Ind., to Blue Island, Ill., is projected, and the Indiana State Legislature is to be asked to make an appropriation towards the expenses. As far as Gary, Ind., the canal would be 25 ft. wide, with 15 ft. of water; beyond that point it might be made larger in order to accommodate lake steamers. The canal would pass through Indiana Harbor, East Chicago, Whiting, and Hammond. C. W. Hotchkiss, Gen. Mgr. of the Chicago, Indiana & Southern Ry. at Chicago, is said to be interested in the promotion of this project.

RAILROAD SUPPLIES.—Atlanta, Ga.—Bids were received as follows on Oct. 21 by R. V. LaDow, Supt. Prisons and Prisoners, Dept. Justice, Washington, D. C., for furnishing and delivering at the United States Penitentiary, Atlanta, Ga.: (a) steel rails, angle bars, rail braces, tie plates and spikes: (b) 110 ties, 7-in. by 9-in. by 8 ft., treated with creosote: Niagara Falls Steel Co., Buffalo, N. Y., rail braces, $7.50; tie plates, $12.50; rails, $25. R. C. Hoffman & Co., Baltimore, Md., rails, $204; joints, $27.38; braces, $10.50; tie plates, $28.80; spikes, $6.75. Hart Steel Co., Atlanta, Ga., tie plates, $18.50 and $20; braces, $60 and $23.35.

DITCHES.—Paragould, Ark.—Bids are asked until 11 a. m., Nov. 17, at the County Court-House, Paragould, for construction of a ditch to straighten Eight Mile Creek, Cache River Drainage Dist. No. 1. Total length, nine miles. Estimated quantity, 435,546 cu. yds. Ditch starts in the town of Paragould and extends to the St. Francis River. For plans and specifications address Lund & Hill, Consult. Engrs., Little Rock, Ark.

Bids are asked until Nov. 17 for the following ditch work in Hurricane Drainage District No. 1: 8½ miles dredging ditch, 193,000 cu. yds., and 8½ miles team ditch, 47,000 cu. yds. J. D. Mitchell, Greenway, Ark., is Engr.

SEAWALL.—San Francisco, Cal.—Bids will be received until 3 p. m., Nov. 19, by the State Harbor Commissioners, Ferry House, San Francisco, for furnishing material, including stone and constructing Section 11 of the sea wall from the northerly end of Section 12, a distance along the water front of 600 ft. It is estimated that the stone sea wall will require about 85,000 tons of stone (of 2,000 lbs. per ton); of this amount, 73,000 tons of smaller stone will be required for core of embankment, and about 12,000 tons of large stone for outer slopes. The stone must not be subject to decomposition or disintegration by the action of the sea water or air. W. B. Thorpe, Secy. Bd.

DOCK.—East Boston, Mass.—The contract has been awarded to SNARE & TRIEST, 143 Liberty St., New York, for the construction of the new Cunard dock at East Boston to replace the terminal destroyed by fire on July 8. The pier for the Cunard line will be constructed before work on any of the other destroyed docks are commenced. It will be a steel structure. The east side of the pier will be 782 ft. long, while the west side will have a length of 621 ft. The overall width of the pier will be 240 ft. and the covered portion 220 ft., Sections 3 and 4 will be 1-story, while 1 and 2, where the passengers are landed, will be two stories. The building will be made as nearly fireproof as possible. Estimated cost, $125,000.

TELEPHONE LINE.—Mill Hall, Pa.—The ERDMAN-GESSNER CO., of Lock Haven, Pa., has been awarded the contract for building and installing complete the new telephone line of the Mill Hall & Lamar Telephone Co. This line will connect with the Bell System in this city. The same contractors have also been awarded the contract for building and equipping the new telephone line for the Nesbit Telephone Co., which will extend from Mill Hall to Williamsport, a distance of eight miles, and will connect with the Bell System at the latter place. The Mill Hall-Lamar line will be eleven miles in length. Both contracts include installing the private telephones in the residences and business places of the subscribers along the entire line.

FIREBOATS.—San Francisco, Cal.—Bids were received on Oct. 21 by the Board of Public Works for construction of two fireboats, to be known as the "David Scannell" and the "Dennis T. Sullivan." The contracts for the two fireboats, which are to be a part of the auxiliary fire protection system, was let to the RISDON IRON WORKS, of San Francisco, at $262,200. Two other bids were received—that of the Union Iron Works, for $274,620, and the United Engineering Works, for $275,990. The Board also approved the plans for the pumps and turbines for the fire protection system, and also for the salt water pumping stations. Bids for this work, which the engineers estimate will cost $267,000, will be received on Nov. 18.

PIER, DREDGING, ETC.—Philadelphia, Pa.—The City Council's Committee on Navigation and Commerce on Oct. 22 approved the budget of the Department of Docks for next year, calling for an appropriation of $2,378,520. It included $1,000,000 for the purchase of property and the construction of a double-deck freight pier at Vine St., which will come out of the $13,500,000 loan; also for deepening and widening ship channel in the Schuylkill River, $100,000; for dredging private docks where city sewers enter Delaware and Schuylkill Rivers, $50,000; for removal of bars and shoals inside of pier head line in front of docks, where latter are deeper than entrances, $50,000, and for dredging city docks and repairing wharves, landings and recreation piers, $35,000.

WHARF AND DREDGING.—Norfolk, Va.—Bids were received as follows on Oct. 17 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for a timber wharf about 350 by 50 ft., and dredging about 40,000 cu. yds. of mud, etc., at the navy yard, Norfolk: (a) for work complete according to plans, (b) for work complete with modifications: Bernard Rolf, 39 Cortlandt St., New York, N. Y., (a) $33,333. McLean Construction Co., 902 Maryland Trust Bldg., Baltimore, Md., (a) $26,250; Wm. L. Miller, 19 Milk St., Boston, Mass., (a) $29,490, (b) for wharf $27,950, and for dredging $13,000; W. D. Murray, 211 Citizens' Bank Bldg., Norfolk, (a) $33,977; Coastwise Dredging Co., Bank of Commerce Bldg., Norfolk, (b) $36,200; Sanford & Brooks Co., 24 Commerce St., Baltimore, Md., (b) $33,300; Phoenix Construction Co., 41 Park Row, New York, N. Y., (a) $25,314; Penn Bridge Co., 312 Bond Bldg., Washington, D. C., (a) $24,940.

BREAKWATER, WHARF.—Ottawa, Ont.—Bids are asked by the Department of Public Works at Ottawa, Ont., Nap. Tessier, Secy., as follows: Until 4.30 p. m., Nov. 6, constructing wharf at St. Andrews, N. B.; until Nov. 10, constructing wharf at Barton, N. B.; combined breakwater and wharf at Lorneville, Reed's Point, N. B.; Nov. 13, construction of breakwater at West Advocate, N. S., and for building an extension to east pier at Quaco, N. B.; Nov. 16, wharf at Pointe à Brousseau, Gaspe County, Que., and constructing an extension to head block of pier at Riviere Blanche, Rimouski County, Que.; Nov. 16, dredging in Middle Channel River, St. Lawrence, between Kingston and Brockville, Ont.; Nov. 23, constructing an extension to West St. wharf at Pelee Island, Essex County, Ont.; Nov. 27, constructing a wharf at the mouth of the Michipicoten River, Dist. of West Algomo, Lake Superior, Ont.; Nov. 27, for construction of a timber wharf and ice breaker at Three Rivers, Que.

Bids are also asked by the Department of Public Works until Nov. 19 for construction of a dam, bulkheads and slide at the head of Long Sault Rapids, Ottawa River, in the Township of Gendreau, Que.; Nov. 19, for constructing an extension to the breakwater at Devil's Island, N. S.; Nov. 16, for extension to wharf at Providence Bay, Ont.; Nov. 19, for construction of breakwater at Minasville, N. S.; Nov. 23, for the construction of a roadway and enlargement of block at Ste. Emilie (Leclercville), Lotminiere County, Que.

## CIVIL SERVICE EXAMINATIONS.

LABORATORY ASSISTANT.—Washington, D. C.—The U. S. Commission announces an examination on Nov. 25, to secure eligibles from which to make certification to fill a vacancy in the position of Laboratory Assistant qualified in optics, Bureau of Standards, at a salary of $900 to $1,200 a year, and vacancies requiring similar qualifications as they may occur in that Bureau. Age limit, 20 to 35 years. Application Form 1312. Applications must be filed prior to closing hour on Nov. 14.

EDITOR.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Nov. 24-25 to secure eligibles from which to make certification to fill a vacancy in the position of Editor in charge of the Departments of Entomology, Economic Zoology and Veterinary Science in the Experiment Station Record, Office of Experiment Stations, Department of Agriculture, at $1,500 a year, and vacancies requiring similar qualifications as they may occur in that department. Age limit 20 years or over. Application Form 1312.

JUNIOR CHEMIST.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Dec. 2-3, to secure eligibles from which to make certification to fill vacancies as they may occur in the position of Junior Chemist, in the Technologic Branch of the Geological Survey, at salaries ranging from $840 to $1,200 a year. Temporary appointments to the position of Chemical Aid or Apprentice may also be made from the list resulting from this examination of those receiving a rating between 60 and 70, at salaries ranging from $600 to $700 a year. Age limit, 21 years or over. Application Form 1312.

JUNIOR ENGINEER.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Dec. 2-3, to secure eligibles from which to make certification to fill vacancies as they may occur in the position of Junior Engineer in the Technologic Branch of the Geological Survey, at salaries ranging from $840 to $1,200 a year. Temporary appointments to the position of Engineering Aid or Apprentice may also be made from the list resulting from this examination of those receiving a rating between 60 and 70, at salaries ranging from $600 to $780 a year. Age limit, 21 years or over. Application Form 1312.

## CONTRACT PRICES.

INTERCEPTING SEWER.—Galion, Ohio.—Bids were received by the Board of Public Service, John T. Shea, Clk., on Oct. 19 for constructing about three miles of trunk line sewer. Bradbury & Shute, Engrs., Columbus, Ohio. Bids in detail were as follows: (A) A. J. Stough, Galion; (B) P. Drake & Sons, Marion, Ohio; (C) J. Murphy & Co., Marion; (D) U. S. Construction Co., Columbus, Ohio; (E) H. J. Glover, Lorain, Ohio; (F) H. W. Mathews, Lorain; (G) L. P. Batterfeld, Bucyrus, Ohio; (H) Stratton & Applegate, Alliance, Ohio; (I) Price & Hurley, Marion:

| | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) | (I) |
|---|---|---|---|---|---|---|---|---|---|
| 14,000 cu. yds. earth excavation | $0.50 | $0.50 | $0.52½ | $0.44½ | $0.34 | $0.40 | $0.40 | $0.77 | $0.40 |
| Excavation for siphons, etc. (lump sum) | 3,200.00 | 590.00 | 1,000.00 | 890.00 | 400.00 | 500.00 | 1,600.00 | 480.00 | 400.00 |
| 128 cu. yds. brick masonry | 18.00 | 10.00 | 9.90 | 10.50 | 10.00 | 9.00 | 9.00 | 15.00 | 14.00 |
| 50 cu. yds concrete | 5.00 | 8.00 | 6.60 | 7.25 | 8.00 | 6.00 | 8.00 | 8.00 | 7.00 |
| 2,805 ft. laying sewer 12" or less | .06 | .10 | .08 | .10 | .07 | .10 | .20 | .12 | .07 |
| 2,189 ft. laying sewer 15" and 18" | .10 | .10 | .09 | .12 | .10 | .15 | .22 | .20 | .09 |
| 9,508 ft. laying sewer, 20", 22" and 24" | .13 | .10 | .13 | .14 | .15 | .20 | .25 | .30 | .10 |
| 15,392 ft. laying subdrain | .11 | .02 | .08 | .12 | .09 | .07 | .15 | .12 | .05 |
| 33 standard manhole tops | 9.00 | 8.00 | 6.60 | 7.50 | 8.50 | 9.00 | 16.00 | 8.00 | 8.00 |
| 25 tight manhole tops | 10.00 | 8.00 | 6.60 | 8.90 | 8.50 | 9.00 | 16.00 | 10.00 | 8.00 |
| 25 manhole pans | 4.00 | 3.00 | 2.20 | 2.00 | 3.00 | .30 | 5.00 | 2.50 | 2.50 |
| 250 manhole steps | .30 | .40 | .20 | .20 | .20 | .30 | .40 | .25 | .20 |
| 1 M. ft. B. M. timber found | 45.00 | 60.00 | 25.00 | 30.00 | 38.00 | 30.00 | 40.00 | 25.00 | 30.00 |
| 38,642.25 ft. list sewer pipe | 85% | 84% | 81% | 83½% | 80% | 82½% | 82% | 83% | 80½% |
| 140 Y poles | .08 | .25 | .02½ | .25 | .15 | .05 | .30 | .05 | .15 |
| 116 tons cast-iron pipe | 32.30 | 35.00 | 36.00 | 31.70 | 29.00 | 40.00 | 34.40 | 40.00 | 33.00 |
| 1.27 tons cast-iron specials | 34.00 | 60.00 | 90.00 | 70.00 | 57.00 | 65.00 | 100.00 | 80.00 | 75.00 |
| 10 inspection covers | 5.00 | 5.00 | 5.50 | 2.90 | 4.00 | 4.00 | 4.00 | 2.00 | 5.00 |
| 25 vent caps | 3.00 | 5.00 | 5.50 | .50 | 2.00 | 3.00 | 3.00 | 1.00 | 2.00 |
| 1 12" gate | 90.00 | 40.00 | 55.00 | 30.00 | 39.00 | 60.00 | 50.00 | 40.00 | 45.00 |
| | $27,887 | $22,384 | $24,454 | $23,389 | $22,026 | $23,440 | $26,933 | $31,111 | $22,537 |

## U. S. POSSESSIONS AND CUBA.

LOCOMOTIVES.—Panama.—Bids were received on Oct. 26 at the office of the Isthmian Canal Commission for furnishing two four-wheel saddle tank locomotives, weight about 18 tons, delivery free of all charges by steamer on dock at Colon or La Boca. The lowest bidder was the Lima Locomotive & Machine Co., Lima, Ohio, $5,800; weight, 17 tons each; delivery, first in seven weeks, second in nine weeks. Next lowest was the Vulcan Iron Works, Wilkes-Barre, Pa., $5,-900; delivery four and six weeks.

## INDUSTRIAL NOTES.

THE BETHLEHEM STEEL CO, South Bethlehem, Pa., announces the removal of the New York office to 111 Broadway, New York City. Mr. J. M. Ellis has been appointed sales agent for this company in New York.

KEUFFEL & ESSER CO., Hoboken, N. J., has opened a branch house at 253 Notre Dame St., W., Montreal, Que., where a full stock of drawing materials, mathematical and surveying instruments, measuring tapes, etc., will be carried.

THE CORNELL ECONOMIZER CO. and David Townsend, Consulting and Mechanical Engineer announce their removal on Nov. 1, 1908, to new offices, 55 De Long Bldg., southeast corner 13th and Chestnut Sts., Philadelphia, Pa.

THE ABERTHAW CONSTRUCTION CO., of Boston, has recently received the contract for replacing an old log crib dam at Saxton's River, Vermont, with a modern dam of concrete construction. The work is to be done for Sidney Gage & Co.

THE NEBRASKA CORN PRODUCTS CO., of Beatrice, Neb., recently placed an order with the Minneapolis Steel & Machinery Co., Minneapolis, Minn., for a 16 × 36 heavy duty Twin City Corliss engine for the new plant which they are building.

THE RAYMOND CONCRETE PILE CO., of New York and Chicago, has been awarded the contract for placing Raymond concrete piles in the foundations of a machine shop, warehouse and stables that are being built for the Ford & Kendig Co., at 24th and Wood Sts., Philadelphia.

THE MURRAY IRON WORKS CO., Burlington, Ia., has issued a three-color picture of a Murray Corliss engine mounted on a mat 9 × 13 ins. ready for framing, which the company states will be sent to any engineer in charge of a power plant who agrees to frame and hang it in his engine room.

THE WATERPROOFING CO., 147 East 35th St., New York, has been awarded the contract and is now at work upon the waterproofing of the new New York State Education Building in Albany. This contract is one of the largest contracts ever awarded for the waterproofing of the foundations of a building.

THE UNITED CIGARETTE MACHINE CO., of Lynchburg, Va., which has used several Foos engines in its power plant for eight or ten years, has recently placed an order with the Foos Gas Engine Co., of Springfield, Ohio, for one 100-HP. multiple cylinder vertical engine and producer gas plant complete. The engine will be direct connected to a General Electric Co. dynamo to supply current for the operation of their new plant, which is nearing completion.

**For other Proposal Advertisements see pages 47, 48, 49, 50, 52, of Advertisements and Construction News page 164.**

## SANITARY SEWERS AND SEWAGE DISPOSAL PLANT.

READVERTISEMENT.

Rye, N. Y.

Sealed proposals will be received by the Trustees of the Village of Rye, New York, at the Municipal Hall of the said Village, at 8 P. M., November 18th, 1908.

Said proposals to cover the furnishing of materials and the performance of labor required for the construction of certain sanitary sewers and of a sewage disposal plant, in accordance with plans and specifications now on file in the charge of the Village Clerk.

Copies of the specifications and plans may be seen also at the office of the engineer, G. Everett Hill, 156 Fifth Avenue, New York City.

Approximately, the proposed work consists of:

About 90,000 feet of vitrified pipe sewers, 8-inch to 18-inch, laid complete, with manholes and flush-tanks, much of it in rock excavation.

About 12,600 feet of iron pipe sewers, siphons and force-main, 4-inch to 16-inch.

About 1,200 feet of subaqueous iron effluent-outlet into Long Island Sound.

An indeterminate amount of agricultural drain-tile laid in sewer trench.

Two small pumping stations complete.

Sewage tanks and coke filter-beds, with appurtenances.

A considerable but indeterminate amount of piling and earthwork.

Each bid must be accompanied by a certified check for Five Thousand Dollars ($5,000) as a guarantee that the bidder, if his bid be accepted, will enter into contract and execute the required bond.

Each bid must be made on blank forms to be obtained from the Village Clerk or the Engineer.

The Village reserves the right to reject any or all bids.

All bids must be enclosed in sealed envelopes, marked "Proposal for the Construction of Sewers and Sewage Disposal Works," and each must be enclosed in a second envelope addressed to

THE BOARD OF VILLAGE TRUSTEES,
Rye, Westchester Co., N. Y.
G. EVERETT HILL, Engineer,
156 Fifth Ave., New York City.

## PUMPING ENGINE.

Grand Rapids, Mich., Nov. 2, 1908.

Sealed proposals will be received by the Board of Public Works at their office in the City of Grand Rapids, Michigan, until 8 o'clock p. m., on the 19th day of November, 1908, for the construction, delivery and erection at the Water Works Pumping Station, of one vertical triple-expansion pumping engine, having a normal capacity of twelve million U. S. gallons of water in twenty-four hours. The machinery to be constructed in accordance with specifications on file at the office of the Board of Public Works. Copies of specifications will be mailed upon request.

All bids must be made upon blank form of proposal furnished by the board, and must be accompanied by a certified check drawn to the order of Geo. C. Peirce, President of the Board of Public Works, in the sum of five (5) per cent. of the proposal; said check being returned to the successful bidder on the signing of a contract and the execution of a satisfactory bond of Twenty-five Thousand Dollars ($25,000). The checks of the unsuccessful bidders will be returned to them after the awarding of the contract.

In awarding the contract consideration will be given to general merit of design as well as the price, and the Board reserves the right to reject any or all bids and to accept any bid which the Board may deem to be for the best interests of the city of Grand Rapids.

GEORGE C. PEIRCE,
President, Board of Public Works.

Attest:

SAMUEL A. FRESHNEY,
Secretary and General Manager.

L. W. ANDERSON,
City Engineer.

## WATER-WORKS PUMPING MACHINERY.

Office of Meridian Water-Works Commission.

Meridian, Miss., Oct. 26th, 1908.

Sealed proposals will be received at six o'clock P. M., Tuesday, November 24th, for furnishing and erecting one five million gallon Horizontal Cross Compound Crank and Fly Wheel Pumping Engine, in accordance with the plans and specifications now on file in the office of the Secretary of the Water Commission, and approved this the 19th day of October, 1908.

Specifications and blank forms of proposal may be obtained at the office of the Board.

A certified check on the Meridian Bank in the sum of $1,000 is to be deposited with J. A. Gibson, Treas., before filing bond.

A surety company bond for amount equal to 25% of the gross amount will be required of the successful bidder.

The right is reserved to reject any and all bids.

C. C. DUNN,
President Commission.

W. F. WILCOX,
Engineer.

OFFICE COMMISSIONERS, District of Columbia, Oct. 31, 1908.—Sealed proposals will be received at this office until 12 o'clock noon, November 16, 1908, for constructing trunk sewers in the District of Columbia. Forms of proposals, specifications and necessary information may be obtained from Chief Clerk, Engineer Department, D. C., Room 427 District Building, Washington, D. C. HENRY B. F. MACFARLAND, HENRY L. WEST, JAY J. MORROW, Commissioners, D. C.

## WATER-WORKS.

CHANGE OF DATE.

Las Animas, Colo.

Sealed proposals will be received at the office of the Town Clerk, Las Animas, Colorado, up to two (2) o'clock p. m. of Monday, the 23d day of November, 1908, for furnishing material and labor and constructing water-works improvements as follows:

Complete new pumping plant, including building and equipment.

Steel tank or standpipe.

Extensions and additions to present mains, approximating 23,000 linear feet cast-iron pipe.

All of the above work and material to be furnished and done in accordance with the plans and specifications on file in the office of the Town Engineer, Las Animas, Colorado, and at the office of The W. K. Palmer Company, Dwight Building, Kansas City, Mo.

The work and furnishing of materials will be let as one contract and all proposals must be accompanied by a certified check for five thousand ($5,000) dollars.

All bidders will have ample opportunity to consult the plans and specifications on file, but should any one desire extra copies for personal use, same may be had by depositing ten ($10.00) dollars with The W. K. Palmer Company, Kansas City, Mo., five ($5.00) dollars of which will be returned upon the return of the plans and specifications. The Town reserves the right to reject any and all bids.

IDA Z. LOUDY,
Town Clerk.

W. R. MURPHY,
Town Engineer.

## SEWAGE PUMPING MACHINERY.

Grand Rapids, Mich., Oct. 31, 1908.

Office of Board of Public Works.

Sealed proposals will be received at the office of the Board until Friday, November 27th, 1908, at 8:00 P. M., for sewage pumping station machinery consisting in general of four 40-inch, four 24-inch, and two 18-inch centrifugal pumps; four 175-HP., two 75-HP., two 60-HP., and three 30-HP. electric motors, together with vacuum pumps, piping, etc., according to the plans and specifications on file at the office of the City Engineer.

The Board reserves the right to reject any or all bids.

Each bidder shall deposit with his proposal a certified check or certificate of deposit, payable to the order of George C. Peirce, President, in the sum of five (5) per cent. of his proposal, to be forfeited to the City of Grand Rapids in case he shall fail to enter into contract, in accordance with his proposal, should his proposal be accepted by the Board of Public Works.

All proposals must be made upon blanks accompanying specifications. By order of the Board.

GEORGE C. PEIRCE,
President.

SAMUEL A. FRESHNEY,
Secy. and Gen. Mgr.

L. W. ANDERSON,
City Engineer.

## PUMPING ENGINE AND POWER PLANT.

DEPARTMENT PUBLIC WORKS.

Augusta, Ga., October 28th, 1908.

Sealed proposals will be received by the Water-Works Committee of the City Council of Augusta, Ga., until 4 P. M. (Eastern Time), Tuesday, November 24th, 1908, for furnishing and erecting at Augusta, Ga., a pumping engine of six (6) million gallons daily capacity, and a steam plant of four hundred and fifty (450) horse-power capacity.

The City reserves the right to reject any and all proposals.

Specifications can be had by applying to this office.

NISBET WINGFIELD,
City Engineer.

## ASPHALT PAVING.

Muskogee, Okla.

City of Muskogee, Oklahoma, will let sixteen (16) contracts for asphalt paving, approximately three hundred thousand yards, on Nov. 16. L. B. KINSEY, City Engineer.

PROPOSALS FOR GYM[illegible]RATUS.—Office Constr[illegible] Quartermaster, Prescott, Arizon[illegible] 1908.—Sealed proposals f[illegible] installing Gymnastic A[illegible] Exchange and Gymna[illegible] Barracks, Arizona, will [illegible] until 3:30 P. M., Decem[illegible] then opened. Informat[illegible] this office. CHAS. C. [illegible] Capt. and A. Q. M.


## Situations W[illegible]nted

**Mechanical and E[illegible]ical Engineers.**

MECHANICAL civil engine[illegible] technical education; [illegible] years' experience in mac[illegible] design, concrete mason[illegible] coal handling and conv[illegible] construction work. Of[illegible] including designing, estim[illegible] drafting room and purcha[illegible] competent to take charge[illegible] construction; ambition, ex[illegible] originality and inventive a[illegible] "H. 18," Engineering Ne[illegible] 19-1t

**Draftsmen.**

YOUNG MAN, 24, technical [illegible] Jr. Mem Am. Soc. M. E., exp[illegible] and construction work, first-class draftsman; mills and power houses; desires a position in New York. Excellent references; salary moderate. Address "L. 19," Engineering News, New York. 19-2t

**Superintendents, Misc., etc.**

MASTER MECHANIC with extensive and varied experience constructing and manufacturing in the States, Canada and South America, age 39, desires position where a responsible, high-grade broad-gage man is wanted. Address BOX 720, St. Johns, Oregon. 19-2t

## Situations Open

STRUCTURAL STEEL DRAFTSMAN wanted at once. Must have thorough experience and be capable of putting his work through independently. Apply in writing only, giving references, to THE SNEAD & CO. IRON WORKS, Foot of Pine St., Jersey City, N. J. 19-1t

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FOR SALE.

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of the late Charles Hermany. This library contains over 150 Vols. of choice books on Engineering, Hydraulics, Architecture, etc., also 54 Vols. Engineering News, 28 Vols. Engineering Records, and other leading publications. Bound and unbound copies of Transactions of the American and other leading Engineering Societies. Catalog mailed upon request. Address MRS. CHARLES HERMANY, 1216 Fourth Ave., Louisville, Ky. 19-2t

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**Pumping Plant and Water Works Equipment**

Until recently in operation and supplying twenty-five country residences.

PUMP—Triplex Plunger, Engine or Motor driven, 30,000-gallon Tank and Steel Tower; all accessories. Complete Continental-Jewell Filtration Plant.

Above plant practically new; for sale on account of extension of public service mains. May be seen at Scarsdale, N. Y. Can be installed complete for purchaser if desired.

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**Cambria & Carnegie Sections**

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100 bars 5" 6½-lb. lengths, 35 to 60 ft.
185 bars 6" 8 lb. lengths, 35 to 60 ft.
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115 bars 9" 13¼ lb. lengths, 35 to 60 ft.

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